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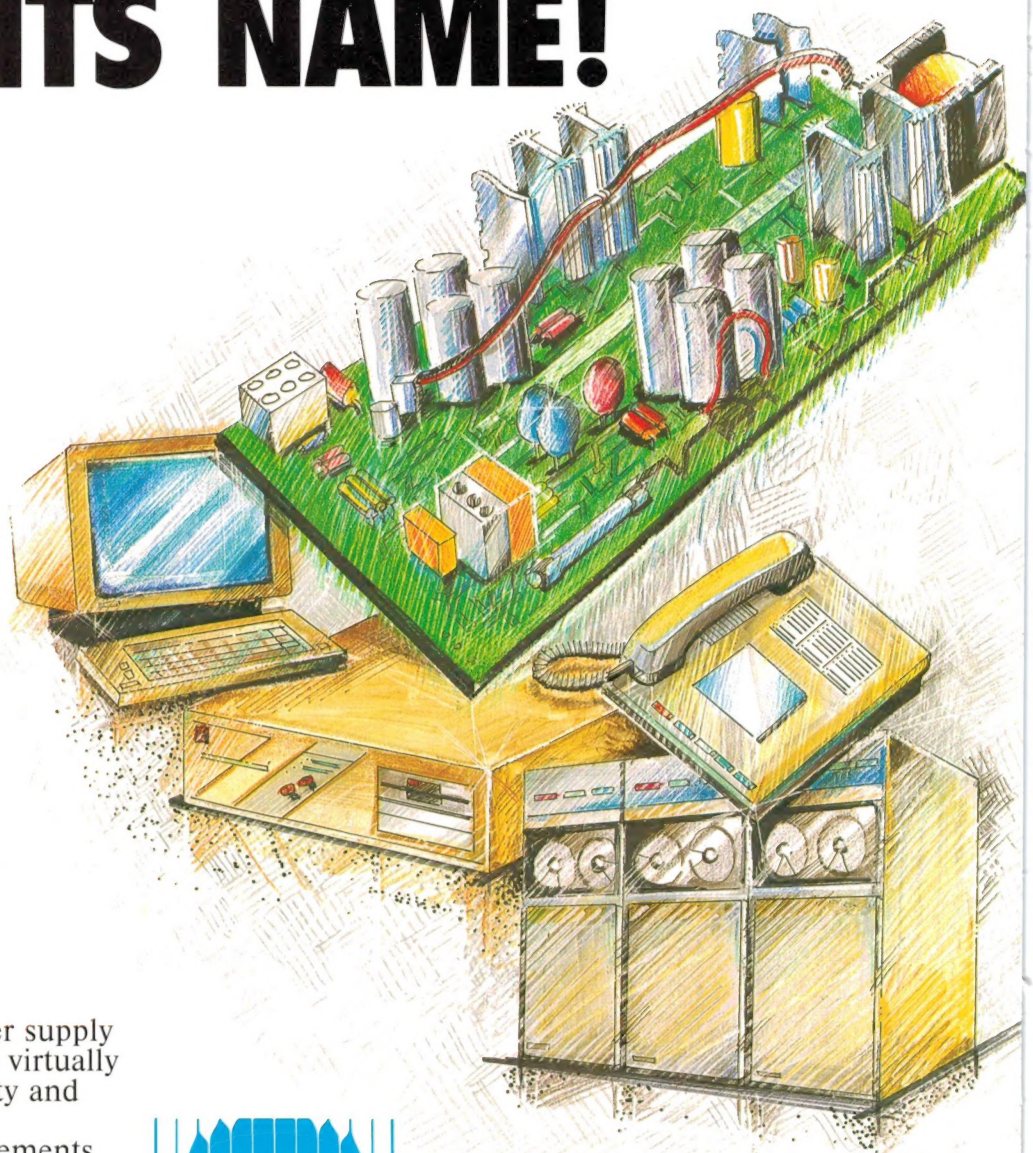

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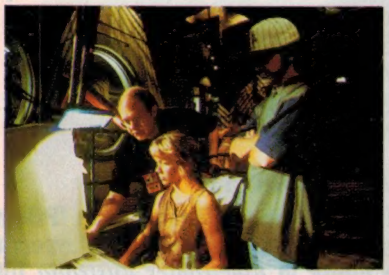
Electronics AUSTRALIA WITH ETI

Volume 55, No.11
November 1993

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922

Beyond *Jurassic Park...*



Californian firm Silicon Graphics has been praised by President Bill Clinton as a model for US high tech industry, and also hit the news for its contribution to the special effects in Steven Spielberg's latest blockbuster. On page 30 we take a closer look at this very successful maker of work-stations and 'visual computers'...

Video editing on a budget

Until quite recently, video editing was strictly for the professionals. But things have changed — the latest generation of consumer video gear can be used to achieve surprisingly good results. Colin Dawson explains, in his story on page 101...

On the cover

There's currently renewed interest in valve-type hifi amplifiers — but just how well DO they compare with the best solid state designs? Reviewer Louis Challis tested the Artemics AS60M pictured this month, to try and find out. His review starts on page 8. (Photo by Kevin Ling)

Video and Audio

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Projects and Technical

Professional Electronics

Columns and Comments

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LETTERS TO THE EDITOR

Marketers response

I refer to Tom Moffat's column; Telemarketing: Tell 'em to cark it', (*Electronics Australia*, August 1993).

I'm sure most of your readers would not share Mr Moffat's views. Would he really have telemarketing banned and thus deny another opening for jobs in these days of 11%-plus unemployed?

Since he's raised the subject however, your readers should be aware that strict guidelines are laid down for telemarketers in the Australian Direct Marketing Association's Standards of Practice. These guidelines state, *inter alia:*

- The advertiser should provide the person called with a clear opportunity to accept or decline the invitation or offer.
- The advertiser should faithfully answer any enquiries concerning the product, service or the solicitation and also truthfully answer any enquiries concerning the source of the potential customer's or donor's name and/or telephone number and any other requested information.
- The advertiser shall not make telephone calls in the guise of research or a survey when the intent is to sell or to solicit.
- The advertiser shall not use any form of recorded message unless the person called can clear the line promptly at wish.
- The advertiser shall identify himself...

Companies in breach of these standards can be censured, fined, suspended or expelled from the Association. Telemarketing is popular with large and small companies alike because it is effective. It has been one of the few growth industries during the recession.

Tom Moffat, or any of your readers for that matter, can easily avoid telemarketing sales calls should they so wish by contacting ADMA on (02) 247 7744 or toll free on (008) 25 2389. ADMA maintains special exclusion lists for just this purpose.

Should any of your readers experience telephone sales callers in breach of the above Standards, we shall be pleased to hear from them since it is important that these Standards be maintained at all times.

The Australian Direct Marketing Association is a non-profit making organisation connected with monitoring, maintaining and enhancing industry standards, and we are always concerned at the potential damage to our industry by those firms who breach the industry's code of conduct.

Stuart Gardiner,
AAG Public Relations Pty Ltd,
For the Australian Direct
Marketing Association.

TAFE concern

I write in reference to 'Private Training?' which appeared in Letters to the Editor in *Electronics Australia* July 1993. I was most concerned to read the remarks of Mr John Bolt in which he makes a generalisation about Teachers' performance at Yeronga College of TAFE.

Since reading 'Private Training?' I have written to Mr Bolt who has provided me with a very lengthy letter detailing his work experience as an engineer and as a student at my College and at other teaching institutions. Mr Bolt's reply to me certainly does not substantiate his claims.

Although Yeronga does not provide the servicing of radio and television sets courses sought by Mr Bolt, it does provide quality hands on training in some areas of electronics. There is considerable evidence of my College's achievement in providing quality training for industry electronics and other fields. Our most recent success for all of the world to see was the bronze medal achievement in Mechatronics of two of my College's students in the Work Skill Olympics held in Taiwan over 24 July to 2 August 1993. At the College we are very proud of Yeronga College of Technical and Further Education and of Australia. In a very competitive field they hold world ranking. We are very proud of the achievements of all of our students.

In letting you know of one of my College's many achievements I am unable to come to grips with the basis for Mr Bolt's earlier claim in *Electronics Australia.*

On the matter of cost of courses — my College charges the course fees set down

by Departmental policy. Along with the staff of the Yeronga College of Technical and Further Education, I am concerned that *Electronics Australia* published the letter.

I ask that you publish this letter as a Letter to the Editor in *Electronics Australia.*

Brian Hutchison,
Director,
Yeronga College of TAFE,
Fairfield Gradens, Qld.

A slap on the wrist!

My compliments to your publication, but I think you need a new complement of proof readers, if the issue of July 1993 is anything to judge by.

There seems to be some reversed polarity regarding the meanings of the words compliment and complement. On page 4, the editor thanked a reader for a complement, and on page 98 the first paragraph starts 'Complimenting the large number...', where the meaning should clearly require 'complementing', i.e, making complete or filling.

Sorry to be pedantic, but *EA* is generally well written, and to see these two errors in one issue made me wonder if you had a new proof reader with their wires crossed.

K.P. Smidt,
Palmerston North, N.Z.

Thanks from winner

Many thanks for selecting my entry in the Yaesu FRG-100 competition. It's great to be associated with two giants of the Australian electronics scene, yourselves and Dick Smith Electronics.

I received the FRG-100 on Monday 30th August, courtesy of Richard Allen of Dick Smith's Ringwood Store. I've been test driving it for a couple of weeks and it's really looking good. Maybe now I'll get a crack at some of those stations mentioned in Arthur Cushen's columns. I've been listening to shortwave for many years — but not with anything quite like this. My last two receivers have been Sangeans, purchased from DSE.

Thanks again for the receiver, and thanks for a great magazine.

David Williams,
Ringwood, Vic. ❖

Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of *Electronics Australia.* We reserve the right to edit letters which are very long or potentially defamatory.

EDITORIAL VIEWPOINT

Worthwhile moves toward reducing computer power consumption

Recently I attended a media briefing by NEC Home Electronics Australia, on the current moves — originating in the USA — to reduce the energy consumption of computers and their peripherals. I found the briefing most interesting, because it explained the connections between a number of trends evident lately from overseas news stories. Trends like the move by CPU chip makers like Intel to incorporate 'power saving' features in *all* of their chips, not just those for laptops; the move by video monitor makers such as NEC to incorporate similar features in their monitors; the move by laser printer makers like Apple, Canon and H-P to reduce the power consumption of their printers; and the recent development by the US Video Electronics Standards Association (VESA) of its 'Display Power Management Signalling' (DPMS) system, to allow the 'next generation' of PCs to control the activity status of their monitors.

What triggered this all off, it seems, was a study by the US Environmental Protection Agency (EPA) which showed that the country's 35 *million* PCs represent the fastest-growing section of total electrical energy demand. As a result, President Clinton recently signed an 'executive order' to the effect that from October 1, 1993, the US Federal Government (which accounts for something like 10% of the total US computer market) can only buy computers and peripherals which conform to the 'Energy Star' policy developed by the EPA. In a nutshell, this requires each computer and peripheral device to enter a low-power 'idling' state — where it individually draws less than 30 watts — when it has not been activated for a reasonable time.

Needless to say, this initiative by the US has galvanised the world's computer and peripheral product makers into action, even though the Energy Star program is coyly described as a 'voluntary partnership'. Clearly a good deal of this motivation to join the program stems from commercial considerations, but at the same time it is surely going to bring tremendous benefits not only for the US and its environment, but ultimately for the rest of the world as well. (At least in the long term — I only hope that countries like Australia won't find themselves used as 'dumping grounds', for products that will no longer sell in the USA.)

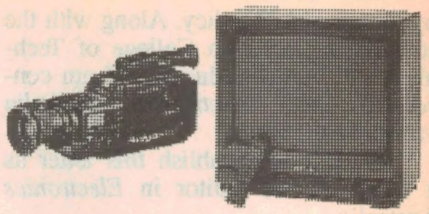
The EPA has apparently predicted that by the year 2000, its Energy Star program should save *25 billion* kilowatt-hours of energy annually, in the USA alone. This would be enough to power the states of Vermont and New Hamshire, and corresponds to a total saving of about US$1 billion in energy bills. Also reduced will be emissions of the 'greenhouse' gas CO_2 (about 20 million tonnes less), and pollutants sulphur dioxide (140,000 fewer tonnes) and nitrogen oxides (75,000 less tonnes).

It's pretty impressive, isn't it? And even though our own government doesn't seem to be too eager to introduce an Energy Star program of its own, it looks as if we'll ultimately get the benefits anyway — thanks to this commendable initiative by the US Government, and its 'buying might'.

By the way, as you might perhaps expect, NEC has announced a new range of 15", 17" and 21" monitors which *do* conform to the Energy Star requirements — by means of an inbuilt 'Intelligent Power Manager'. If you're in the market for a new monitor, they're worth considering...

Jim Rowe

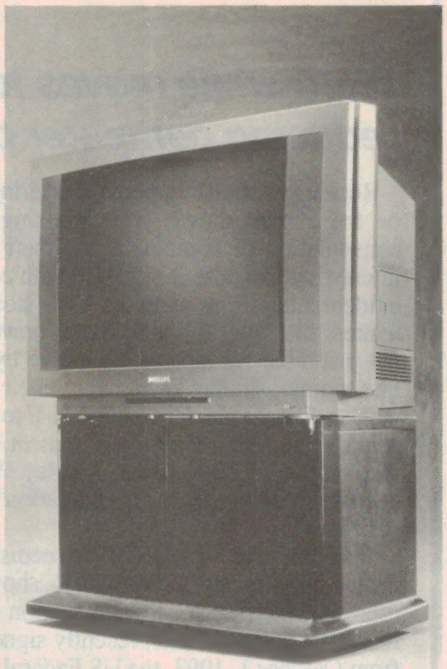
What's New in VIDEO and AUDIO



New 'Matchline' TV from Philips

Philips has released a new range of large screen Matchline stereo television receivers which it claims will set a new industry benchmark for high quality picture and sound — plus friendly controls. Philips says its engineers paid great attention to attaining the highest levels of resolution, sharpness and contrast on a superflat screen, for the new models. A five speaker system and subwoofer also provide excellent sound quality.

A feature of the Matchline series is the ease of making adjustments, using the remote control and on-screen menues. There are three choices of colour temperature: a low setting for viewing in a darkened room; a normal setting; and a higher setting for brightest colour intensity in light conditions. Inbuilt artificial intelligence (AI) circuitry adjusts clarity to suit the program received, giving depth and realism. The AI also controls the scanning speed for enhanced detail.



important feature of the new Matchline range is that the styling and look of the receivers is the work of an Australian team of designers.

Having worked on Philips' projects for more than a decade, the Sydney-based Blue Sky Design team was commissioned by the Philips corporate design centre in Holland to develop a stylish television, worthy of the technology inside. Unusual for large screen TV's, the control panels of the new Matchline are on the top of the sets — eliminating 'stoop-to-adjust' — and the controls are helpfully backlit. All cable sockets — such as VCR and aerial inputs — are also at the side of the cabinet, making installation far simpler. For neatness the cables are hidden behind a door and channelled to the back and out of sight.

The Matchline range will offer a choice of three model sizes: 68cm stereo, expected to be the volume seller at a recommended retail price below $2000; 65cm stereo with text; and 59cm with text.

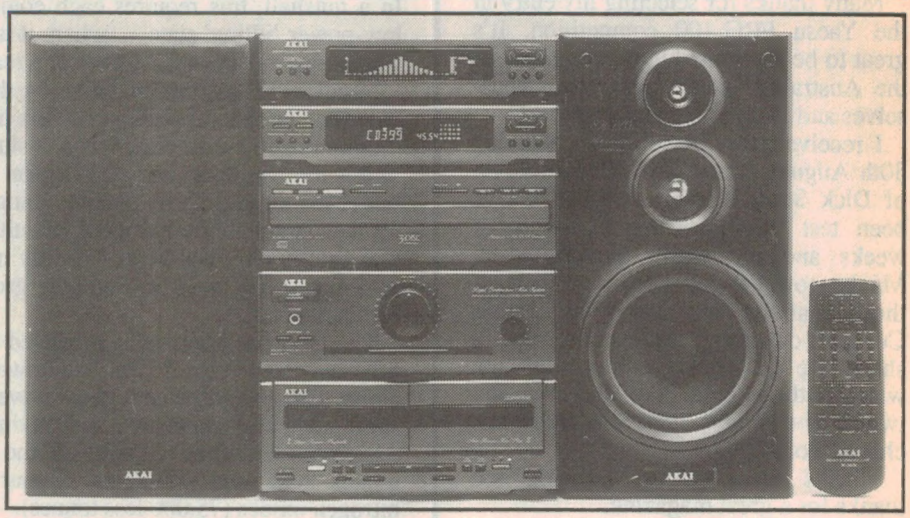
Akai updates triple CD mini

Akai has expanded and enhanced its successful MX Mini Series, incorporating the world's first triple CD changer, with a totally new flagship model, the MX-770.

Similar to quality European designs, the MX-770 features brushed aluminium front panels and features a high powered separate power-amp and comprehensive separate pre-amp. A motorised volume control is also featured, offering greater reliability and lower noise characteristics than cheaper electronic types.

Another outstanding feature of the MX-770 is the Digital Sound Processing (DSP) mode which recreates the ambience of classic mode, for fuller more dynamic classical music; stadium mode for an outdoor concert effect; and church mode for a rich musical cathedral resonance. A total of up to 10 modes can be selected and later recalled from memory via the use of a seven band graphic equaliser combined with a 21-bar spectrum analyser.

Incorporating Akai's 'world first' triple



CD carousel changer, the MX-770 also uses single-bit dual D/A converter technology which is claimed to offer outstanding linearity.

The triple changer measures only 27cm wide and can be programmed to play for up to 30 selections from any of the CDs or play all tracks at random.

Another feature of the triple CD changer is the ability for the user to change the discs while the main disc is still playing. Other features of the MX-770 include 50 watts/channel output, full remote controller, 30 pre-set AM/FM stereo tuner, double cassette deck and three way speaker systems.

The MX-770 has an RRP of $1499 and is covered by a 12-month parts and labour warranty. It is available at selected Akai dealers and department stores.

Surround-sound speakers from Dali

Dail has released two high quality, yet affordable surround-sound speakers for increasingly popular home theatre systems. For those who desire the realism and thrills of a fine surround-sound theatre system, but at an affordable price, the new speakers are claimed to be ideally suited.

The CS-1 is a slim, compact centre-channel speaker using high quality components. The speaker is magnetically shielded, allowing close placement to a television set without affecting picture quality. The twin 10cm bass/midrange drivers feature polypropylene cones with a large magnetically shielded motor assembly.

The 25mm tweeter from Vifa features ferro-fluid oil cooling and mu-metal magnetic shielding. The compact dimensions at 125 x 430 x 180mm (HxWxD), ensure that the centre channel speaker fits easily above or below the television set. Retail price for the CS-1 is $299 per pair.

The Dali-SAT is a compact two-way speaker designed especially for front or rear effects speakers in surround-sound systems. The small size (200 x 135 x 88mm) and rounded front baffle allow the speaker to integrate well with modern decors. Dali-SAT is supplied with its own 'ball and socket' mounting joint, allowing the speaker to be tilted and turned to suit individual rooms and systems. Available in both black and white finishes, Dali-SAT retails for $299 per pair.

For further information circle 181 on the reader service coupon or contact Scan Audio, 52 Crown Street, Richmond 3121; phone (03) 429 2199.

New amps from Harman Kardon

After a long absence from the market, Harman Kardon has re-entered the separate preamplifier/power amplifier market place.

"This is a significant addition to the already extensive quality audio product line-up," states Geoff Matthews, Marketing Director of Convoy International, Australian distributors for Harman Kardon.

This year Harman Kardon has been in business for 40 years. To celebrate, it released the 'Signature Series', distinguished by a comparative plaque with Dr Sidney Harman's signature inscribed. "It is most unique that Dr Sidney Harman, 'founding father' of the hifi industry, is still at the helm of the company that bears his name," states Matthews.

Three new power amplifiers PA2100 (65W/ch), PA2200 (100W/ch) and PA2400 (200W/ch) have the job of driving the loudspeakers and are equipped with upgraded components to provide effortless sound and exceptional reliability.

An interesting innovation is the 'music sensor' power saver circuit, which detects the presence of signal from the preamplifier and shuts down to 'stand-by' mode after a short period of 'no signal'. When in this mode the power amplifier instantaneously switches back on when a signal re-appears.

The PT2300 tuner/preamplifier has a RRP of $1249, the AP2500 preamplifier $2100 and the power amplifiers PA2100 $949, PA2200 $1499 and PA2400 $2300.

The Signature Series is now available at all Harman Kardon stockists, with the exception of the AP2500 and PA2400 which are due for release in December.

Better sound for retailers

Good quality sound is vital to setting the right atmosphere in a retail shop, yet it is one aspect which is often not used to its full advantage, according to Bob Schenk, the General Manager of Bose Australia.

Mr Schenk said that many retailers make the mistake of installing hifi systems which are not designed for a commercial environment.

"Many retailers simply install their favourite home stereo system in their shop," Mr Schenk said. "However most home systems are not able to reproduce quality sound in a retail environment."

Bose has recently introduced a new sound system called FreeSpace, designed specifically to suit the needs of retailers. Mr Schenk said the FreeSpace system was based on extensive research to ensure lifelike, high fidelity reproduction in retail areas of all sizes.

"The main advantages of the system are high quality sound, easy installation, virtually invisible speakers and long term reliability. Active equalisation and patented dynamic equalisation result in full rich sound coverage at all volumes, for every customer, regardless of where they are in the room."

The FreeSpace system has also been designed to blend in easily with existing decor. Each speaker is only about the size of a small milk carton and can be mounted inconspicuously on ceilings or walls. Like the speakers, the bass box can be painted to match the room or hidden out of sight.

For further information circle 185 on the reader service card or contact Bose Australia, phone (008) 023 367.

TDK supports both Mini Disc and DCC

TDK has now confirmed its long awaited MD-XG Mini Disc to the Australian market. The MD-XG (Excellent Digital Grade) Mini Disc is available in both 60 and 74 minute playing times.

The MD-XG is designed to be fully compatible with the MD format and being both recordable and erasable represents a significant breakthrough in digital signal processing and magneto-optical recording technology.

The magneto-optical disc offers similar performance to CD including playback time, frequency response, and dynamic range — but has the added option to make your own digital recordings.

Over 10 years of research and development into optical recording media led to the development of the new MD-XG Mini Disc, according to TDK. MD-XG employs a specially developed magnetic layer of Terbium Ferric Cobalt (TbFeCo) alloy, formed into a six-layer structure using a proprietary sputtering technique.

The result of this research is a material that exhibits the highest sensitivity and high output for reliable record and playback characteristics.

Prices for the MD-XG60 and MD-XG74 are $19.95 and $23.95 respectively. TDK's new Mini Discs will be available at selected dealers only. ❖

ARTEMICS AS60M STEREO VALVE POWER AMPLIFIER

How good *were* the best valve or 'tube' stereo amplifiers of the 1960's, before they were replaced by solid state designs? And how do today's 'new generation' valve amplifiers compare with the latest solid state amplifiers? This month Louis Challis tries to answer these and related philosophical questions, while simultaneously reviewing the impressive Artemics AS60M amplifier...

One of the deep questions which each of us has asked ourselves during our lifetime, and on which many religions are so firmly based, is 'whether there is a life after death'. If we set aside the immortality of our own lives, which most of us do at some stage, then one of the most outstanding, if not downright peculiar rebirths — after being pronounced dead by nearly all the relevant commentators — is that of valve amplifiers, which seemed to have been dealt a death blow by the development of outstanding transistor amplifiers.

Thirty years ago, transistor amplifiers were all the rage and valve amplifiers had become *passe*. Anybody who was *anybody* was discarding their large, hot and fragile valve amplifiers for small, cool, and — generally far more expensive — transistor amplifiers. Mullard and Philips had released their OC16's, which were then 'state of the art' power transistors, and I and many others used them to design and construct relatively simple push-pull amplifier output stages, which could easily produce 20 watts of relatively cool output.

Whilst the first and second generation power transistors proved to be well suited for loudhailers and other mundane undemanding PA applications, they had insidious characteristics which rendered them far less appropriate when attempts were made to apply them to high-quality applications. Those particular applications were only then being qualified by the four-letter word 'hifi' — whereas in contrast, the transistor amplifiers which were offered for similar applications were all too often labelled by far more pejorative four-letter words!

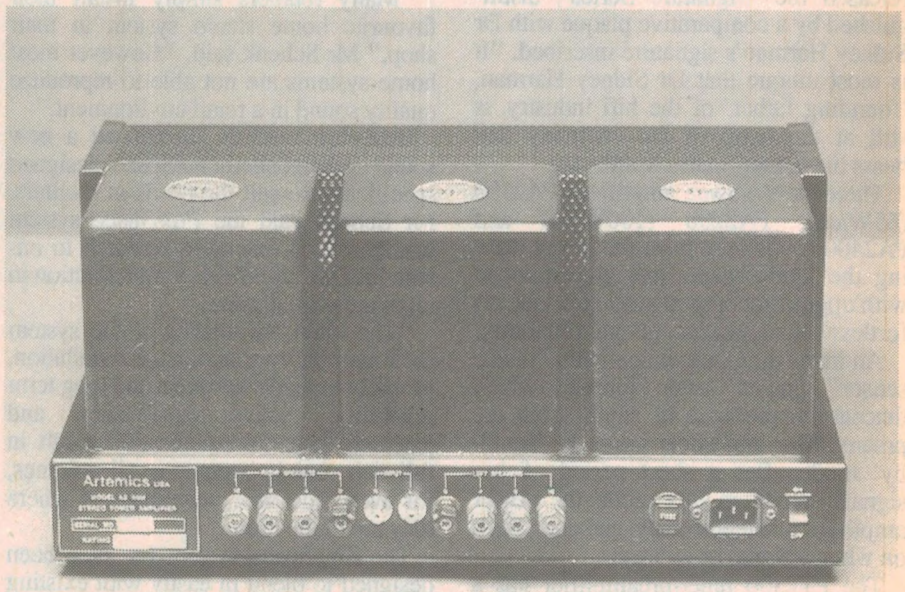
It took another 10 years, to a period somewhere between 1973 and 1975, before the majority of serious reviewers and equally serious consumers were prepared to accept transistor power amplifiers on an equal footing with the best valve amplifiers, in the 'high fidelity stakes'. During that 10-year period from 1963 to 1973 a prodigious amount of research and development was applied to the development of low distortion, low noise transistor power amplifiers. The objective was to obviate the very clear problems which plagued the first, second and even third generation of these amplifiers.

Valve amp features

Now the best valve power amplifiers had a number of significant attributes, the most important of which was most probably their adoption of 'Class A' circuitry. This ensured smooth, seamless crossover characteristics in push-pull output circuits, well controlled and reasonably low third-order harmonic distortion, and a 'mellow' sound which everybody loved, and which evoked widespread acclaim.

That doesn't mean to say that *all* valve amplifiers were good. Rather, that the best amplifiers were exceptionally good, whilst the others were generally reasonably good.

In the decade between 1955 and 1965, high fidelity valve amplifier circuit design had made great strides, and the best of those amplifiers (like the ultra-linear amplifier designs developed by *Electronics Australia*, the high-powered KT66 amplifiers developed by AWA, and the Murray amplifiers developed by the Electrical Engineering Department at the University of Sydney), were all outstanding even when assessed by the higher standards that prevail today. The amplifier design techniques developed during that decade put the best valve amplifiers at the



The rear of the amplifier provides terminals for speakers of different load impedances, as you can see, plus the usual RCA input connectors and an IEC mains input connector with switch (far right).

very top of the class, so that the early transistor amplifiers faced what then seemed to be an almost insurmountable hurdle in bridging the gap.

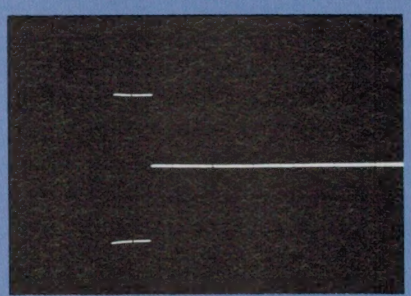
But given sufficient time, when the relevant research is lubricated by appropriate funding, it is wonderful what can be achieved. In the following 20 years that gap was bridged, so that today the finest transistor amplifiers are every bit as good as (some say even better than) the best valve amplifiers of 1965.

By 1990, there were relatively few valve manufacturers left in the world, as relatively few people were either designing, let alone manufacturing valve operated equipment. If you had asked me in 1990, what the prospects were for somebody (anybody for that matter) marketing valve amplifiers in open competition to transistorised amplifiers, my response would have been courteous but brief.

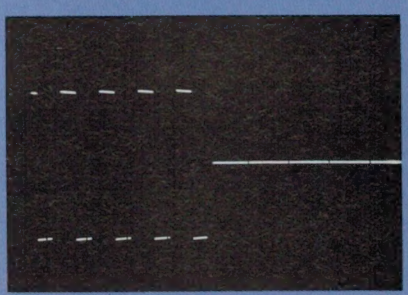
If you had asked me the same question in 1993, the answer would still have been equally courteous, but it would no longer be as brief. I am now aware that for some almost inexplicable reason, valve amplifiers are suddenly the flavour of the month. But explaining *why* valve amplifiers have risen 'like the proverbial Phoenix from the grave', and have re-asserted a position in the marketplace, becomes a trifle more difficult for me to explain in objective and sensible terms.

As a child I was entranced by the soft red glow of the valves installed in my family's radio in the living room. The feelings of wonderment and novelty that those valves imbued in most children (who became many of today's adults) were real, and perhaps still are the 'stuff from which legends are made'.

Overload Recovery Tests



2kHz Tone Burst
20ms/division



2kHz Tone Burst
0.5ms/division

Transistors are relatively cold and metallic, and without any grace-saving visual attributes. Valves are warm, illuminated even when not working, and thus have the ability to excite both our auditory and visual senses. With that as a starting point, and when appropriately marketed on the basis of their 'newness', their 'difference' and their claimed 'superior characteristics' when compared with transistors, we have the makings here of a superior marketing program — one that no transistor amplifier can ever hope to match in quite the same way.

There are of course some relatively prestigious people who have jumped onto the valve bandwagon. In the developmental league, people like Bob Carver are now producing CD players with valves in them (what next!).

And as Selwyn Sayers of *EA* itself has joyfully pointed out to me, Edge of 'U2', Slash of 'Guns & Roses', Eddie Van Halen, Jimmy Barnes, John Entwhistle of 'Who' and Brian May of 'Queen' all apparently use valve amplifiers in preference to transistor amplifiers — either for their own pleasure, or in some cases for live performances.

With that sort of recommendation, who am *I* to argue with the concept or the underlying philosophy of valves

versus transistors (I'll have more to say about that later).

By now you must be starting to question my sanity (that is unless you are already sold on the concept of valve amplifiers and have traded in that ubiquitous 100 or 200 watt transistor amplifier for one of these new 'you beaut' valve amplifiers which are now turning up in increasing numbers at some of the better hifi retailers! Well, let's try to put the whole issue into some sort of perspective.

The Artemics amp

As it happens, *EA*'s editor was recently offered for review an Artemics AS60M Stereo Tube Power Amplifier, which uses four KT88 pentodes in the output stages (two in each), and which is undoubtedly more attractively constructed than any valve amplifier that I have seen in recent years (let alone 30 years ago). Jim and I both thought this high-quality amp would make a good representative of the 'reborn' valve amps, both to evaluate their performance and to compare them with modern transistor technology.

The Artemics AS60M uses special oxygen-free copper (OFC) custom wound output transformers, 1% precision MIL standard resistors and computer quality capacitors, for both the power supply filtering as well as for the active electronic circuitry.

I carefully read the brochure provided, did a double-take at the way some of the words were spelt, and then realised that the Artemics AS60M amplifier is manufactured in China. I suspect that a large proportion of the intending purchasers (quite apart from the manufacturer's personnel), may have not previously seen a valve amplifier, and would consequently regard this amplifier as being 'state of the art' esoteric equipment.

In their day, the KT88's were a mighty potent valve, and when appropriately configured, could provide power outputs of 60 - 70 watts. In those days this was regarded as BIG POWER...

Today many people are *blase* about power amplifiers which produce less than 200 watts continuous output and I note that the very same Bob Carver who has joined the valve band wagon, has just developed a new line of transistorised amplifiers, which are capable of delivering 800 watts into a four-ohm load. Power is obviously important; but potentially a smidgin less important than most people are prepared to accept, and especially where quality sound 'rules supreme'.

The Artemics AS60M is relatively neat, using a strong and beautifully constructed chassis, with three large and neatly boxed transformers along the back of the chassis. The internals of these transformers are permanently hidden from view, but they add so much weight that the amplifier's centre of gravity is disturbingly shifted towards the back.

In front of the two output transformers and central power transformer are the four bulbous KT88s, directly in front of which are pairs of 6DJ8 and 12AU7 driver valves — which I must admit I hadn't seen around for more than 20 years. On the neat front panel of the amplifier is a little green LED, whilst at the back are the power 'on/off' switch and multiple spring-loaded terminals providing the ability to match load impedances of 16, eight and four ohms respectively.

The valves are provided with a supplementary perforated cover which provides very essential physical protection, particularly when moving the amplifier. As I confirmed, its presence ensures that you don't destroy your brand new toy by dropping discs, records, or children's toys on top of those fragile glass envelopes. (Nowadays, valves like the KT88 are surprisingly expensive!)

Objective testing

The objective testing of the AS60M amplifier proved to be far more straightforward than I would have expected. As I soon discovered, the frequency response was far better than I would have expected in terms of my prior experience (which stems back more than 30 years, to the days when valves were 'King of the Castle').

The AS60M has an extremely smooth response over the critical frequency range of 25Hz-20kHz, with an overall deviation of generally far less than 0.1dB, whilst its overall frequency response is +/-1dB from 5.6Hz to 80kHz. I have to admit that I was impressed by that performance, as the majority of valve amplifiers I have tested in the past were hard pressed to achieve a 30kHz bandwidth.

I next progressed to assessing the amplifier's power output, which the glossy brochure claimed as being 70 watts per channel into an eight-ohm load. In contrast, my measurements revealed that the amplifier's output at the onset of saturation (as determined by comparing the output directly against the input using the X-Y display of the cathode ray oscilloscope, to detect the onset of clipping) was 41.4 watts per channel.

That power output figure left me a trifle disappointed, as I had visions of the early Japanese radios (circa 1960) for which the manufacturers measured and glibly quoted the square-wave output into a

Measured performance of Artemics AS60M
Serial No. 00208

Frequency Response (-1dB re one watt) Input to Aux = 0.5V	**Tone Controls Defeated** Left 5.6Hz to 80kHz; Right 5.8Hz to 81kHz			
Sensitivity		**Left**	**Right**	
	Auxiliary	142mV	127mV	
		dB	**dB**	**dB**
Harmonic Distortion		**100Hz**	**1kHz**	**6.3kHz**
a) At a power of 41.4 watts into eight ohms = 18.2 volts	2nd	-45.5	-63.1	-54.5
	3rd	-41.7	-40.5	-41.5
	4th	-46.7	-48.7	-66.9
	5th	-41.2	-41.5	-
	THD	1.40%	1.32%	0.86%
b) At one watt into eight ohms	2nd	-49.4	-60.9	-62.0
	3rd	-63.6	-77.3	-67.4
	4th	-	-	-
	5th	-	-	-
	THD	3.45%	0.091%	0.09%
Noise and Hum Levels Relative to one watt into eight ohms with volume control set for one watt output with 0.5V input (Aux input, shorted)	66dB(Lin) 90dB(A)			
Maximum Output Power at Clipping Point (IHF-A-202) 20ms burst repeated at 500ms intervals	52V p-p = 42.3 watts			
Therefore dynamic headroom	= 0.1dB (re 41.4 watts)			

Channel Separation	**20Hz dB**	**100Hz dB**	**1kHz dB**	**10kHz dB**	**20kHz dB**
Right to left	73	74	98	84	78
Left to Right	85	82	97	87	83

Output Impedance (@ 1kHz) 826 millohms

resistive load, for a sinewave input signal — so that they could claim the then-magical 'one watt output'. Whilst the AS60M amplifier may well achieve 70 watts with a square-wave output, I place little importance on such figures.

I progressed to an assessment of the signal to noise characteristics of the AS60M amplifier, and was again impressed by its 90dB(A) weighted signal to noise ratio relative to one watt. But I was less impressed by its unweighted signal to noise ratio of 66dB, relative to one watt.

When these figures are related to the 40-watt output, the hum and noise figures are of course 16dB better. However the glossy brochure quotes hum and noise as being '84dB below rated output', which the measured A-weighted figures beat by a mile. But the unweighted figure is actually 2dB less than claimed.

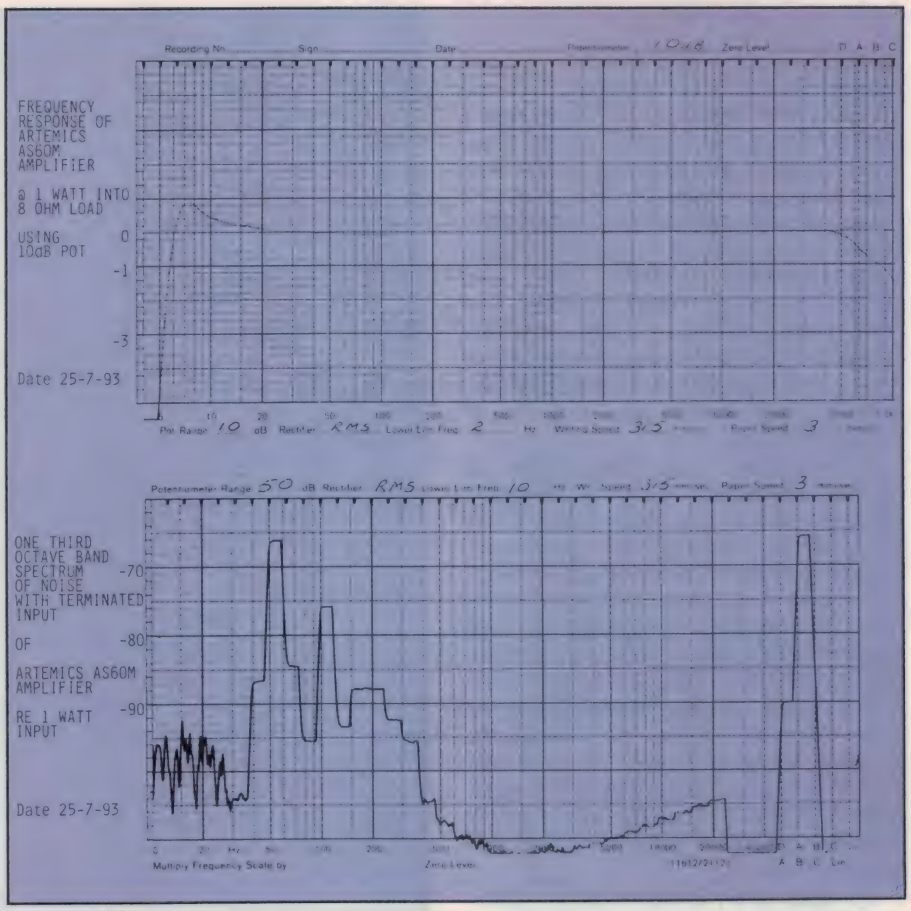
An examination of the one-third octave band frequency response with the input terminated reveals the classical dominant 50Hz hum (-66dB), significant quantities of 100Hz hum (-76dB) and high order harmonics still readily visible (although not audible).

The total harmonic distortion figures of the amplifier are reasonably good when compared to other valve amplifiers, but fall well short of the figures which I have come to expect from the better (let alone the best) transistor amplifiers. As you will note from the attached table, the third harmonic figures are significantly higher than I would have expected on the basis of the relevant classical theory, which says that valve amplifiers have lower third harmonic distortions, and that is what makes them sound so good. With distortion levels of less than 2 - 5%, a valve amplifier sounds great. When you push it any harder, like any other amplifier, the distortion becomes disturbing.

I measured the IEC high frequency total difference frequency distortion characteristics of the AS60M, and noted a smooth and gradual increase in the distortion characteristics right up until 42.3 watts into eight ohms — where there is a very sharp knee in the curve. At that point, the characteristic changes to an almost vertical line, and the subjective and audible characteristics of the amplifier become 'something else'.

The channel separation figures are considerably better than I would have expected, being better than -73dB for the right channel into the left at 20Hz, climbing up to -98dB at 1kHz, and dropping back to -78dB at 20kHz.

The measured output impedance of the amplifier is 826 milliohms, which is a trifle higher than the best output impedance figures that I can recall from other large valve amplifiers that I tested decades ago, but that figure is still quite acceptable.



The frequency response of the Artemics amplifier is commendably flat from 20Hz to 40kHz, with only small deviations at either end. As with other valve amplifiers, there are significant 50Hz and 100Hz hum components in the noise spectrum.

The last test I performed was the overload recovery test, using the IHF-A-202 test signal, which confirmed that the amplifier's recovery from overload is rapid and without any sign of instability.

Listening tests

I picked up the AS60M and discovered that its weight is a discouragement to moving it unless you really have to. Undaunted, I then lugged it home — where it replaced a Yamaha M40 amplifier which I have been using, and which has more than five times the power output capability per channel. I connected the amplifier's output to a pair of B & W 801M Series II monitor speakers, and subjected it to some mighty telling subjective evaluations for a period which extended over one month.

The software I used consisted of my standard repertoire of test discs, a number of vinyl records (for old times' sake) plus some exciting new CD software with which I had been specially provided for this particular subjective evaluation.

The first disc that I used is Claude Debussy's *The Martyrdom of Saint Sebastian*, which is incidental music to the mystery in five acts written by Gabriele D'Annunzio (Sony Classical SKJ48240). This is hauntingly beautiful music, and has the added notoriety that the principal narrator is Leslie Caron, who many of you may well remember from her days of cinema stardom.

The amplifier's performance was excellent, and it provided a level of performance which was almost indistinguishable from the trusty and excellent transistor amplifier that it replaced. The orchestral and choral presentation in *Martyrdom of Saint Sebastian* was a good test, but because my French is not good enough, Leslie Caron's diction did not provide me with the voice content that I really needed for a full subjective evaluation of the human voice.

I then played Chesky Records latest 'potpourri' disc called *The Collection* (Chesky PJD 1000). This disc contains a number of my favourite vocal pieces from other Chesky discs which I had previously purchased, and includes amongst others on track No 3, the famed Sara K singing 'Wanna Spend More Time'. This is an excellent track with which to evaluate the spoken (singing) voice, and I have used the original disc repeatedly for that purpose in the last few months.

With Sara K singing her number, I was able to hear subjective differences be-

tween the Artemics AS60M and the Yamaha M40 amplifier, which provides a premium yardstick for such comparisons. The AS60M certainly sounded different, but I am far from convinced that it sounded better than the Yamaha amplifier. What I was *not* able to do was switch instantaneously between the two amplifiers and the same speakers. Nor was I able to perform a 'double blind test'. So in the end, that evaluation led me to the conclusion (which others have previously made before me), that not all amplifiers sound alike!

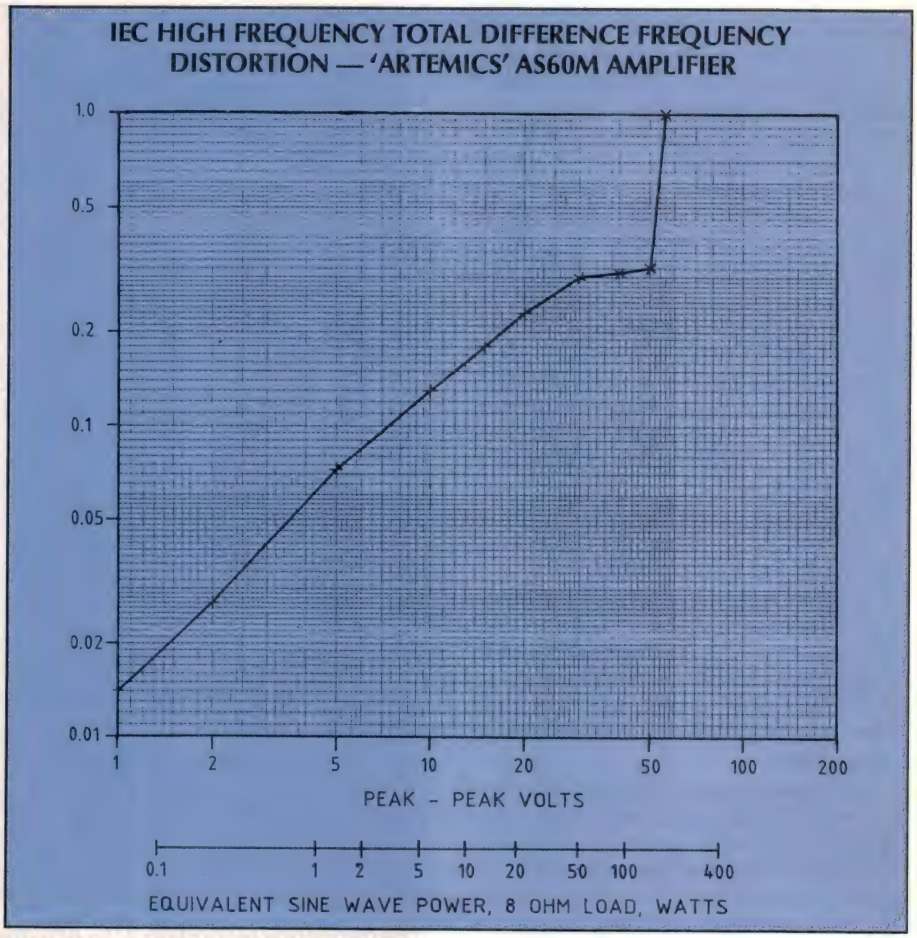
I progressed onto Chesky Records Audiophile Gold CD *O Magnum Mysterium*, with the Westminster Choir. This features some of the most beautiful and exquisitely recorded sacred liturgical music that I have heard in recent years. I compared the Audiophile Gold version against the conventional version, and couldn't detect any difference. What I was aware of however, when playing the three different versions of 'Ave Maria' (namely those by Verdi, Bruckner and Stravinsky), was that the AS60M does provide a distinctly 'mellow' sound which provides a most sympathetic reproduction of such music.

I progressed on to Mendelssohn's *Overture & Incidental Music to A Midsummer Night's Dream* with Yoel Levi conducting the Atlanta Symphony Orchestra (Telarc CD-80318), together with the *Italian Symphony No 4*. This is an absolutely delightful disc with beautifully recorded music, and in this the AS60M absolutely revelled. I was deftly transported out of my living room to another era, to share the excitement that this music first created when it entranced the London audience who were fortunate enough to hear its premiere performance.

Summarising...

Valve amplifiers have some perceived advantages, and some equally obvious limitations. Unlike transistors, valves tend to exhibit slow but gradual changes in their transfer characteristics with increasing age, and that factor tended to be the most telling and significant reason for many consumers to make the switch from valve operated equipment to transistorised equipment.

Valve amplifiers do sound 'different' from transistor amplifiers, and I have most certainly reconfirmed that fact during the subjective evaluation which I performed for this review. Valve amplifiers cannot currently produce power outputs comparable with the biggest transistor amplifiers, and consequently if power is the name of your game, then I suggest that valve amplifiers are not for you.



The distortion characteristics of the Artemics amplifier, as measured by Louis Challis using the IEC high frequency total difference method. The distortion level remains low until an output level of 42 watts is reached, and then rises steeply.

Of course the nub of this review is not whether valve amplifiers sound different, but rather whether they sound *better*. I realise that what I am about to say is heretical, but based on my subjective evaluation, I am simply unable to support the contention that they do.

The die-hard valve supporters will undoubtedly contest my conclusion, with suggestions that I have become inured to the characteristics of transistor amplifiers from more than 20 years of exposure. My response is that such criticism is basically correct, and like it or not, I have come to the point in time where I now prefer the aural characteristics of the best transistor amplifiers to those displayed by the best valve amplifiers.

As for the Artemics AS60M amplifier itself, it certainly provides an exceptionally smooth performance from very low listening levels (involving power outputs of a watt or more) all the way up to its peak output of 41 watts per channel — where supply rail clipping starts to limit its potential.

At low listening levels, the AS60M appears to be marginally smoother than transistor amplifiers against which I compared it. At modest listening levels (i.e., peak outputs in my listening room of up to 105dB), it is almost indistinguishable from the transistor amplifiers — that is, until you start to make demands, as are created (for example) by the firing of the cannon in Tchaikovsky's *1812*.

This amplifier really achieves its *forte* with classical music, and preferably with speakers offering reasonable efficiency. It is really best at home, in a small house or apartment, where the *quality* of music is pre-eminent rather than its peak level.

But in order to make a valid and realistic decision on what will ultimately be perceived as a very personal issue, you will really have to sit down in a quiet listening room, and audition the Artemics AS60M yourself before you can either support or dispute the question as to whether there is 'a life after death for valve amplifiers'.

The dimensions of the Artemics AS60M Stereo Tube Power Amplifier are 204 x 475 x 330mm (H x W x D), and it weighs 27.2kg. The quoted recommended retail price is $3890.

Further information is available from the distributor, A-One Electronics, 432-434 Kent Street, Sydney; phone (02) 267 4819, fax 267 4821. ❖

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VIDEO EDITING WITH CONSUMER EQUIPMENT - 1

Here is the first of two articles discussing the ways in which the latest generation of reasonably-priced consumer level equipment can be used for video editing, to achieve a more professional result. In this instalment the author looks at VCRs and edit controllers, after first explaining how the traditional distinctions between 'professional' and 'consumer' video gear are rapidly fading away...

by COLIN DAWSON

Until quite recently, video editing was strictly for the professionals. The cost and complexity of equipment meant that you had to make a serious commitment. But over the last couple of years, the price and performance of top-end consumer equipment has improved dramatically. The S-video formats, Hi-8 and S-VHS, have brought far superior video quality into the home, and now manufacturers have begun loading VCRs and camcorders with sophisticated editing facilities.

In Europe, video equipment with editing potential is keenly sought. But here, the same models go almost unnoticed.

Trying to gauge the potential of various systems is not easy, because in Australia consumer video editing is a no-man's-land. In discount electrical stores you will probably get a blank look or perhaps a brochure, while professional equipment sellers can tell you about gear that costs as much as a family car. If you want to make an informed choice on the cheapest way into video editing, then, start here...

This article and its sequel will present a snapshot of consumer gear that can currently be used for video editing, ranging from the cheapest warts-and-all facility through to near-professional equipment.

Prices in this article

Please note that the prices given here are recommended retail, unless quoted as 'street price'. It is usually possible to negotiate package deals at prices lower than the recommended retail. Prices were correct at the time of researching, but do not include any possible flow-on from the 1993 budget.

Do it yourself

Traditionally, if you wanted training or promotional videos, you called in the professionals. Unfortunately, the cost has been prohibitive for many companies. A video could have been a really useful supplement to their in-house training program, but was just too expensive. But now, for about the cost of a desktop publishing facility, you can be making videos.

Think of the advantages: if part of your training program changes, you can alter the video in a day or two, and at very small cost. With a little re-editing, the training video can become promotional. Companies that depend on successful bids and proposals for their living can spice-up dull documentation with a complementary video to get the client interested.

Maybe you want to edit some video from a friend's wedding or a school sports day, or perhaps you just want to tidy up your home movies to increase your enjoyment of them. All of these things are practical and don't have to be outrageously expensive.

So what is the absolute rock-bottom entry-level kit going to cost you? The answer is 'about $4000', but that is not really an answer at all, since there are so many considerations and pitfalls that you need to think about carefully.

For the minimum feasible facility, you would get two VCRs, an edit controller, a monitor and a simple audio mixer. Sure, you may have a friend who makes home movies by synchro-editing from a camcorder to a VCR, but this is not viable if you want people to take your videos seriously (as distinct from cornering friends and relatives with your latest holiday video...).

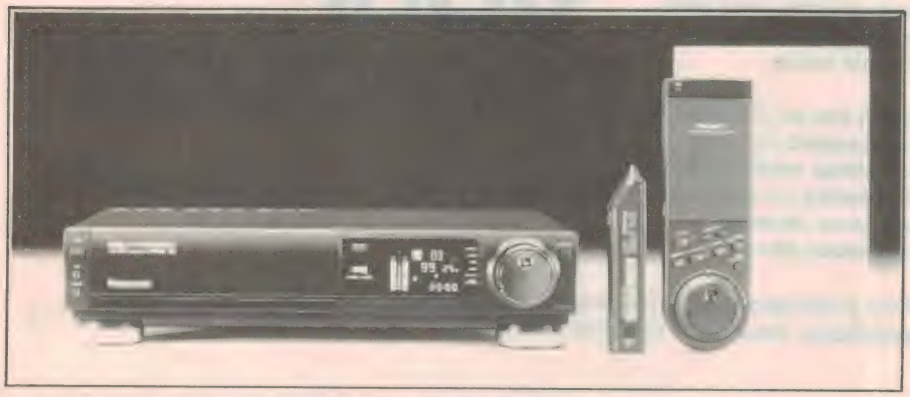
Choosing your VCRs

The VCRs that you choose will influence the cost and quality of your productions more than anything else. They must be S-video machines (i.e., S-VHS or Hi-8), have insert editing, flying erase heads, audio dubbing and an edit controller interface. The last requirement is the tricky one — it eliminates most of the consumer machines.

(Actually, some edit controllers have an infra-red interface for the VCRs, and can learn the control signals for a variety of machines. Theoretically, VCRs can then be used for editing without having an edit controller interface.)

Without an edit controller, you have to rely on 'synchro' editing, where you manually cue up the player and recorder machines, then hit the record button. The recorder sends a pulse to the player and they both do their thing — but repeatability and accuracy are poor, even by consumer editing standards.

S-VHS offers the cheapest way into video editing with the Panasonic NV-



The Panasonic VC-FS90 which has a street price of around $1500 or less.

FS90, which has a street price of around $1500 or less. This has Panasonic's proprietary five-pin edit controller interface.

Although Panasonic quote an editing accuracy of only plus/minus one second using the VW-EC300E controller, I have found the machines to be much better than that. They usually give about plus/minus eight to 12 frames.

Moving up a little are two Blaupunkt VCRs, which are actually clones of Panasonic models not sold in Australia. The RTV-925 S-VHS machine is just under $1800 and is similar to the NVFS90, but has amorphous heads, an automatic head cleaner, and NTSC and SECAM playback.

It also has 'sound search', where the sound is not muted during shuttle mode. This makes life a lot easier when you are editing interviews and you want to cut at certain words rather than the image.

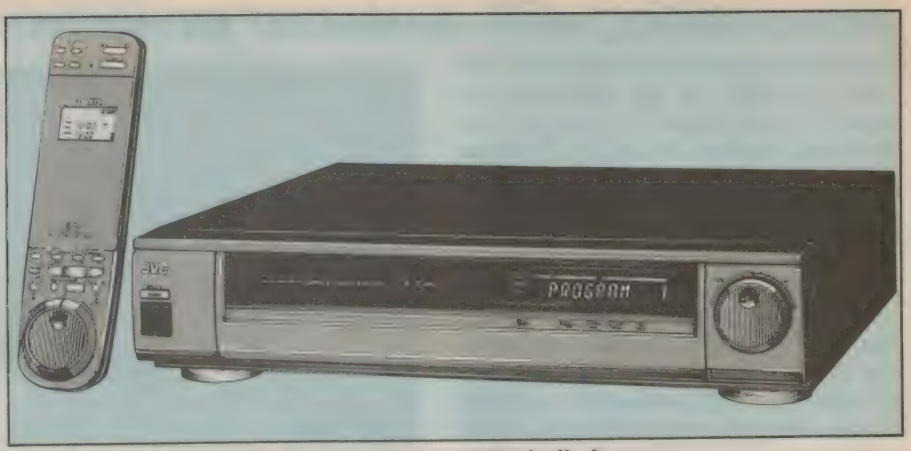
Next stop is the RTV-950PC at $3200, which additionally has a built in two-line timebase corrector. This should be a serious improvement to the problem of drop-outs caused by camcorders (more about timebase correctors in the second article). The RTV-925 has Panasonic's five-pin interface, while the RTV-950PC has an RS-232C serial data interface.

JVC's recently released HR-S6800 VCR manages to sidestep the issue of an edit controller, because the VCR actually has an edit controller built in. At $2199 they are more expensive than many consumer S-VHS machines, but this is largely offset by the fact that you don't have to buy a separate edit controller. They also have some nifty features like 16:9 wide-screen and a surround sound processor with a menu of sound modes.

The HR-S6800 has a circuit to reduce video head switching noise, which can be apparent as a flickering spot on the bottom of the monitor. The jog/shuttle control of this VCR is a little sluggish when you first change direction, at least compared to the instant response of the FS90. This may be due to a mechanism which is claimed to improved tape-to-head contact.

The Sony EV-S1000E is the only Hi-8 VCR that qualifies as consumer and it comes in at a recommended retail price of $3999. This has Sony's Control-L interface, which will work with Sony edit controllers or some third-party equipment. I was not able to use any Hi-8 gear — it is generally too expensive and too scarce for any demo models to be made available.

One limitation of the EV-S1000E machines is that they are not capable of stepping *backwards* by single frames. To locate the edit points exactly, you would have to use search-reverse and then single frame forward. The higher price of the EV-S1000E is offset by the fact that it has four-channel sound. As well as the standard FM stereo channels, it has a separate PCM stereo capability.



The JVC HR-S6800 VCR has an edit controller built in.

These two channels can be dubbed without disturbing the video and the FM audio channels. Even the professional S-VHS machine can only offer two hifi channels combined with the video, plus two separate not-so-hifi channels. All of the consumer models mentioned in this articles have hifi stereo plus 'lo-fi' mono, where the mono can be dubbed.

Prices get pretty steep after this. Panasonic has the AG-5700 at $4150, or a package with two VCRs and edit controllers for $9750. This has a claimed accuracy of plus/minus two frames and is the least expensive of the machines that Panasonic actually pushes for editing. After this, you are well into professional territory.

Sony has a desktop Hi-8 editing package with the EVO-9700P at about $15,000. The S-VHS player/recorder from Sony is the SVO-9600 at over $6000. Neither Panasonic nor JVC professional S-VHS machines will leave you much change from $15,000 each, although buyers in this category usually negotiate a price for the whole edit facility.

Earlier I rubbished the idea of using a camera for editing, but if your budget just won't stretch to a second VCR it may be the only option — especially if you already have the camcorder. Both Panasonic and Sony have camcorders with an edit controller interface, which gets around the problem of synchro editing.

JVC is about to release the GR-SZ1E, which has a remote control unit capable of edit control, even with other manufacturers' VCRs. Some of the more sophisticated edit controllers can make very good use of the camcorder as a player, sometimes without even the necessity for a full edit controller interface.

In all cases, however, the slow speed of camcorder searching and rewinding is likely to be a source of continuing irritation. On top of that, camcorders have transport mechanisms that are made for light weight, not for durability. Long editing sessions will wear out your camcorder more quickly.

Edit controllers

Edit controllers vary greatly in price and performance, and have a big effect

The Sony EVS-1000E Hi-8 VCR has a recommended retail price of $3999.

on the ease of use of your edit suite. You need to decide on the minimum accuracy that is suitable before you go shopping, because the last few fractions of a second in accuracy represent thousands of dollars in price difference.

US company Videonics has the cheapest edit controller with its 'Thumbs Up' model, which has a street price as low as $455. It can control a range of VCRs and comes with a cable for Sony equipment, or with a Panasonic five-pin cable for an extra $65. Although it has a memory for up to 60 edits, these have to be sequential (i.e., no rewinding). It is claimed to be able to work with Sony RCTC or VITC time codes, which is remarkable for this price.

Sony's RM-E33F 'family editor' at $499 is the cheapest offering random editing, but is only for Sony equipment with the Control-L interface. It has no counter display, and only a four-edit memory.

Offering an eight-edit memory and on-screen display of edit information is JVC's built-in editor for the HR-S6800. It has a claimed accuracy of plus/minus two seconds, but in practice generally gives no worse than about plus/minus one second. Even so, it is the least accurate editing system that I tried — although the on-screen display of edit time (per edit), with cut-in and cut-out times, along with total edit time, is excellent for the price.

When performing insert edits, these must be based on the length of the old material to be replaced, rather than the length of the new material to be inserted. For other edit controllers that support insert editing, you normally have the option to do it either way.

I have one complaint for JVC: the manual assumes that you will be editing with the HR-S6800 and another brand of VCR. It is quite feasible to do this, especially where the other VCR is used as the player. Unfortunately if they are both an HR-S6800, the setup procedure has you flicking back and forward between three different sections of the manual. Once set up though, it is the easiest system of all to use.

The cheapest conventional edit controller with its own counter display and jog/shuttle control is the Panasonic VW-EC300E, at $799. This works with Panasonic (and presumably Blaupunkt) VCRs. Although the edit controller has a frame counter, it only displays whole seconds when connected to an FS90 VCR. Editing is slow: the machines can sometimes dither for 30 seconds or more, apparently searching for the right frame before commencing an edit.

The Alpermann+Velte TE701 at $2799 works to a claimed single frame accuracy.

Except for the Videonics Thumbs Up, none of the edit controllers so far mentioned gives you control over the pre-roll time. (This is the number of seconds that the VCRs 'back up' before commencing an edit.) This is not a problem for the HR-S6800 because it has a long pre-roll time of about 15 seconds. Panasonic's one-and-a-bit seconds seems optimistic.

In the cheapest editing facility, you will probably only have one monitor that is shared by the player and recorder. Most edit controllers leave the switching between player/recorder up to the recording VCR, and that means it has to be stopped in order to view the player. The VW-EC300E is particularly good — it has a switch which allows you to choose whether you have one or two monitors.

If you select one, it switches that monitor between the player and recorder according to whichever VCR is current (and you have complete control over that, no matter what mode the recorder is in).

Videonics offers the DirectEdII controller for $1280. As well as an edit controller, it has a titler, audio fader and graphics generator built in. Like the Thumbs Up model, it can work with

'Insert' versus 'assemble' editing

Insert editing allows you to overlay new video and hifi audio tracks onto an already recorded tape, without disturbing the existing control track. This means you get a smooth transition from the old section to the new, and back to old again.

In the professional environment, insert editing is the usual way. Colour bars are recorded over the whole tape before editing and then the edit material is inserted. This strategy does not work so well in the consumer environment, because the machines can't always insert cleanly. It gets worse with repeated editing at the same point, so that eventually you may end up with a nasty glitch. Even when an insert edit drops in perfectly, there is often discolouration at the edit points.

So why bother with insert editing? Unfortunately, you won't always have a choice, especially when your edit controller is inaccurate. On the first attempt you can *assemble* edit — which is what your camcorder does each time it stops and starts. It works quite well, so long as you have flying erase heads (i.e. the erase heads are mounted on the drum, along with the record heads) and you only add the new scene on to the end of the recorded material. You can't put an assemble edit into the middle of a production: that is where insert editing comes in.

The most expensive consumer edit controllers do not even support insert editing. They just have lots of memory for edits, and are very accurate.

If you don't like the first tape, you just dial in the required changes and let it all run again. This won't work with less accurate systems, because there is no guarantee that successive tapes will be any better than the first.

The MPE-200SX from GSE. At $3100, it includes video fader, colour corrector and other goodies.

time codes; but it has an important advantage, in that it can perform edits randomly — i.e., it has a full edit-decision list capability. Edit information is displayed on screen. It has a setup feature which enables it to learn certain characteristics of a VCR and fine-tune the editing process to suit — a feature generally only found in professional edit controllers.

Sony's contribution to the middle range of edit controllers is the RM-E300, at $1599. It has a display which shows whole seconds and an eight-edit memory. It can also learn infra-red remote control codes, enabling it to work with VCRs from other manufacturers.

The least expensive edit controller that will give you a *frame counter* is the Alpermann+Velte ME-50 at $1352, followed by the Sony RM-E700 at $2099. Both of these work to a claimed single-frame accuracy using Sony's RCTC time code, but can also work without RCTC. Alpermann+Velte has a professional style VITC edit controller, with the TE701 at $2799. This can work with either RCTC, audio time code or without any time code.

I tried the TE701 using a pair of FS90 VCRs, and also using an FS90 and JVC GRS-707 camcorder as the player. It was very satisfying to watch my humble consumer gear performing automatic edits to single-frame accuracy!

Two cautions, though: the GRS-707 camcorder has no *backward* single-frame facility, and I don't know of any current model that does. Also, the TE701 is intended for assemble edits only — it has no controls for insert editing or dubbing. The firm's philosophy seems to be that consumer VCRs can't insert edit properly and you should not be doing it anyway! They could have included a control for audio dubbing, though.

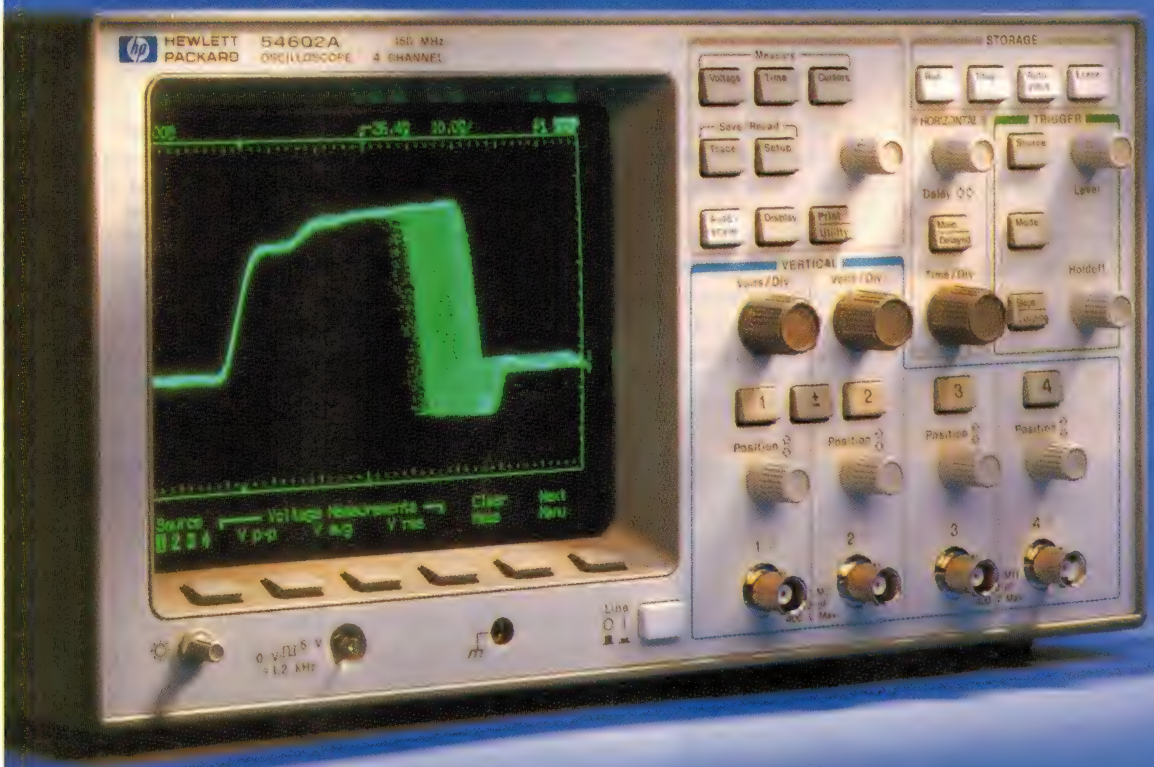
The most expensive and full-featured consumer edit controller is the MPE-200SX from GSE. It can work with standard video time-codes, RCTC, and GSE's own video time-code. (Actually, GSE promotes the fact that its Rapid Time Code has been accepted by JVC as part of the VHS standard. It is used in Europe by Mitsubishi, Siemens and Blaupunkt.)

The MPE-200SX comes in at $3100, but it includes a video fader, colour corrector and some other goodies.

(To be continued) ❖

Win a

Hewlett – Pack



ard Oscilloscope with FFT

Two of these superb Hewlett-Packard, HP54601A 'analog feel' four channel 100MHz digital sampling oscilloscopes to be won when you subscribe to Electronics Australia. That's right, if you subscribe or renew your subscription to Electronics Australia before 26/1/94, you can have an excellent chance of winning one of these highly praised state of the art instruments. We have two of them available, by courtesy of Hewlett-Packard Australia, and each unit is complete with the HP54658A Fast Fourier Transform (FFT) Measurement/Storage module at a further $1,264, this gives a value for each prize of $6,173 or over $12,000 for both prizes.

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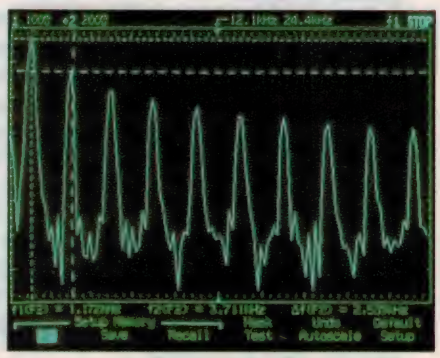

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CONDITIONS OF ENTRY: 1. The competition is only open to Australian residents authorising a new or renewed subscription to Electronics Australia before last mail on 26.1.94. Entries received after closing date will not be included. Employees of the Hannan Group., Hewlett Packard Australia LTD., their subsidiaries and families are not eligible to enter. 2. South Australian residents need not purchase a subscription to enter, but may enter once by submitting their name, address and a hand drawn facsimile of any coupons to the Federal Publishing Company Pty. Ltd., PO Box 199, Alexandria NSW 2015. 3. Prizes are not transferable or exchangeable and may not be converted to cash. 4. The judge's decision is final and no correspondence will be entered into. 5. Description of the competition and instructions on how to enter form a part of the competition. 6. The competition commences 29.9.93 and closes last mail on 26.1.94. 7. The draw will take place in Sydney on 28.1.94 and the winners will be announced in a later edition of Electronics Australia. 8. The prize is 2 x HP54601 valued at $4909 each. 2 x FFT module valued at $1264 each. Total prize valued at $12,346. 9. Subscriptions are not refundable. 10. The promoter is the Federal Publishing Company Pty. Ltd., 180 Bourke Rd, Alexandria NSW 2015. Permit No. TC93/0000 issued under the lotteries and Art Union Act 1901; Raffles and Bingo Permit Board No. 93/0000 issued on 00/00/93; ACT permit no. TP93/0000 issued under the Lotteries Act 1964; NT permit No. 93/000.

'You'll find it at the Patent Office...'

Having trouble designing that circuit? Maybe you've got 90% of a complex design sorted out, but you're out of inspiration for the rest. Perhaps you've seen a device for sale and would like to know how it works. The answer is almost certainly in that most venerable and misunderstood institution, the Patent Office.

by NED STOJADINOVIC

Everyone knows what the Patent Office is. It's the place where you sit around with your little black box on your lap, until some bespectacled clerk calls your name. Then you show him your new butter spreader, splatter his glasses and get your patent. All good, clean fun...

The reality is rather different. The fact is that the world's Patent Offices are probably the greatest storehouses of technical information in the world today. Another reality is that patents are not the result of crackpot inventors, but rather serious engineering designs by serious people such as Sony, Union Carbide, AWA, etc.

For example, I've been working in a patent class concerned with lift controllers lately, and there has been a flood of patent applications dealing with the optimisation of these systems to respond to time-varying and peak traffic such as at the start or end of the day.

These applications are packed with information down to the most intimate levels, and the dissemination of this information is, at least in theory, one of the two basic functions of the patents system.

The first function is the best known and is, of course, the granting of patents; and all patents are lodged on paper only. Boring, but true. All patents in Australia start life as patent applications and are identified by a five-figure number followed by the year of lodgement — e.g., 80486/89. After processing through the system, which can take anything up to two years, the application may be sealed (granted), whereupon it becomes an actual patent and is assigned a six-figure number such as 675490.

Many applications do not make it through this process, and lapse before grant. For example the Patent Examiner might find it's been done before, or that it prevents people from doing something they should be entitled to do. Once granted, however, a patent gives the owner a monopoly on the subject matter contained, meaning the exclusive right to manufacture, sell, and profit from their invention. The normal term of a patent is up to 16 years.

Shown here is the head office of Australian Industrial Property Organisation, Scarborough House in Woden ACT.

WARNING

Do not be tempted to rip-off a patent that is in force. Remember that the owner has the exclusive right to manufacture, sell, etc., their invention for the term of the patent — starting from the time the application is made OPI. So if you see something you like, you are obliged to buy it. Once the patent has expired, however, it is in the public domain and fair game.

It is the second function that we're interested in here. All patents by law must contain a description of the invention, complete and concise enough to allow a person skilled in the relevant art to recreate that invention for themselves. Thus in the case of the lift controllers I mentioned, there must be details of any new circuitry, algorithms, programs, etc.

Furthermore, 18 months after a patent application is lodged in Australia it is made 'Open to Public Inspection' (OPI), meaning that the application, granted or not, is available for perusal to anyone who is interested.

If that's not enough, all the world's Patent Offices are part of a co-operation treaty, which means that any invention of value from any country will usually be patented in Australia as well. Thus you can obtain detailed information on the latest compact disc player designs from Japan, the latest fuel injectors from Germany, or whatever you fancy.

Overseas patent applications become OPI 18 months after lodgement in their country of origin, and consequently also become OPI in Australia at that time.

It's an odd kink, however, that American patents are only published in the US *once granted* — so, given a two-year processing time, are possibly OPI here six months before their own country!

The keys

The main key to this body of information is the International Patent Classification system (IPC), which comes in a set of eight volumes, lettered A - H, plus a 'Catchword Index'. These are available for use at the Patent Sub-offices, which are located in every state; the addresses are given in Table 1.

There is also a *Guide, Survey of Classes and Summary of Main Groups* available, which has some good examples of how it all works at pages 8 - 17. This will also give you a rundown of

OPI DATE 02/04/90 APPLN. ID 35563 / 89

PCT AOJP DATE 10/05/90 PCT NUMBER PCT/US89/00359

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(11) International Publication Number: WO 90/03064

(43) International Publication Date: 22 March 1990 (22.03.90)

(21) International Application Number: PCT/US89/00359

(22) International Filing Date: 30 January 1989 (30.01.89)

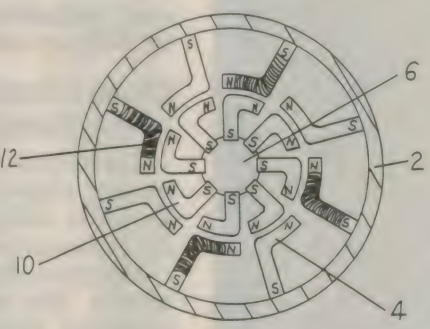
Published
With international search report.

(30) Priority data:
243,632 9 September 1988 (09.09.88) US

(71)(72) Applicant and Inventor: ADOMAITIS, Kenneth [US/US]; 11738 S. Kildare, Alsip, IL 60658-2109 (US).

(81) Designated States: AT (European patent), AU, BE (European patent), BJ (OAPI patent), BR, CF (OAPI patent), CG (OAPI patent), CH (European patent), CM (OAPI patent), DE (European patent), DK, FR (European patent), GA (OAPI patent), GB (European patent), IT (European patent), JP, KR, LU (European patent), ML (OAPI patent), MR (OAPI patent), NL (European patent), NO, SE (European patent), SN (OAPI patent), TD (OAPI patent), TG (OAPI patent).

(54) Title: SELF-SUSTAINING POWER SUPPLYING DEVICE



(57) Abstract

A device for providing self-sustaining means of power containing two circular sets of magnets, an outer stationary set (4) encasing an inner rotational set (10). They are aligned so that their repulsive forces cause the rotation of the inner member, which in turn runs the generator (2). The electricity generated is then used to create a greater repulsive force between the magnets (10, 4), the central armature then spins faster, generating more electricity, and the process repeats itself and provides a self-sustaining means of power for such things as propulsion. Power is delivered through a central member to the machine in question.

A typical application originating in the USA. If you read the abstract, you will realise that HO2P 9/00 is for perpetual motion devices!

TABLE 1:
Australian Industrial Property Organisation offices

SYDNEY
6th Floor, 189 - 193 Kent Street,
SYDNEY, NSW. 2000
Officer-in-Charge: Ms Lea Applebaum
Phone (02) 247 9121
Fax (02) 247 9526

MELBOURNE
15th Floor, 150 Lonsdale Street,
MELBOURNE, VIC. 3000
Officer-in-Charge: Ms Jan Braham
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Officer-in-Charge: Mr Kieran O'Dowd
Phone (08) 362 5665
Fax (08) 362 2006

PERTH
East Point Plaza, 233 Adelaide Terrace,
PERTH, WA. 6000
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Fax (09) 221 1958

HOBART
MLC Building, 65 Murray Street,
HOBART, TAS. 7000
Office-in-Charge: Mrs Margaret Sansom
Phone (002) 205 537
Fax (002) 347 332

BRISBANE
7th Floor, 280 Adelaide Street,
BRISBANE, QLD. 4000
Officer-in-Charge: Mr Basil Clift
Phone (07) 864 8277
Fax (07) 221 3056

CANBERRA
Scarborough House,
WODEN, ACT. 2606
Officer-in-Charge: Ms Susan Ciempka
Phone (06) 283 2311
Fax (06) 281 1841

the jargon which is useful when asking for help or advice.

The IPC volumes of interest to electronics people are G - Physics and H - Electricity. Flip open volume G, for example (feel that sumptuous paper cover); at page 5 or so is the contents, where you will notice that everything is organised in a hierarchical order: G01 is Measuring and Testing, G02 is Optics, and so on.

These are then broken down several more levels in the usual manner — so that, for example, G01R is Measuring Electric Variables/Measuring Magnetic Variables and G01R 13/00 is Arrangements for Displaying Electric Variables or Wave-forms. The final level is for example 'G01R 13/20: Oscilloscopes'.

Another example may be in order: say you are interested in the various aspects of lasers.

A bit of searching turns up H01: Basic Electric Elements and then H01S: Devices Using Stimulated Emission. Turning to the right page you find:

H01S: Devices using Stimulated Emissions
3/00 Lasers
3/02 . Constructional Details
3/025 ..of Semiconductor Lasers
3/03 ..of Gas Laser Discharge Tubes
and so on...

There are two points of interest in this example. The first is that 3/025 had to be inserted when semiconductor lasers were invented.

The second is that 3/03, which is a 'two dot entry', only refers back to the hierarchy level above it — i.e., the 'one dot entry' which is 3/02 Construction Details. So in the case of:

1/00 Masers
1/02 . Solid
1/04 . Liquid
1/06 . Gaseous
1/08 .. Argon

Here 1/02 means 'solid masers' and 1/04 means 'liquid masers', but 1/08 means *gaseous* masers using argon, and has nothing at all to do with solid or liquid masers.

The IPC is quite simple to use, but for historical reasons can be a bit obscure. For example, you might never have thought of looking for lasers under 'Basic Electric Elements' and the people who wrote the first edition probably never dreamed of the future existence of such exotica as lasers.

The solution is the Catchword Index, which acts as a sort of general index for the IPC, and looks an awful lot like the yellow pages in its format.

Continued on page 63

OUR YAESU CONTEST: THE WINNING ENTRIES

As promised, here are the 10 entries in our recent 'If Only They'd Had a Yaesu' Competition which were finally found by our judges to be the most imaginative and entertaining. We had a huge number of entries, and the judges not only found it very difficult to select these 10 entries, but even more difficult to agree upon the ultimate winner of the Yaesu FRG-100.

Dick Smith Electronics store manager Richard Ellen (left), presents contest winner David Williams with his Yaesu FRG-100 communications receiver.

Before we present the winning entries, we'd like to thank *everyone* who entered the competition and made it such a success. We'd also like to thank Dick Smith Electronics, which sponsored the competition and provided the Yaesu FRG-100 Communications Receiver for our prize.

Another comment that needs to be made is that with such a large number of entries, the judges inevitably had a very difficult time in selecting the winners. What made it even harder was that many readers had chosen the same basic historical or anecdotal events on which to base their entry — we had many entries based on the Australian explorers Bourke and Wills, for example, and almost as many dealing with Adam and Eve in the Garden of Eden.

Even *within* these groups many of the entries had come up with almost the same humorous 'twist'...

There were even more problems when it came to selecting the grand winner, once we had finally agreed on the 10 'best' entries. As you can quite often get with these competitions, the judges each tended to differ quite markedly in their ranking of particular entries. So the fairest approach was to add up all of the marks allocated to each entry by all of the judges, and use the totals to determine the ultimate winner by 'mathematical consensus'.

OK, then, with those comments out of the way, let's proceed. The entry which finally won the FRG-100 came from Mr David Williams, of Ringwood in Victoria. Mr Williams' entry touches on a somewhat sensitive topic, and tended to cause some polarisation even in our judges — but despite this, it was still judged the most imaginative and entertaining entry. Mr Williams called it:

Close Encounters of the Worst Kind

"Land ahoy, Cap'n!" The message was instantly relayed to the crew, courtesy of the public address system rigged up by the *Endeavour*'s inventive smithy, Dick.

Aspirations aflame, Cook scanned the horizon. Was this the Great Southern Continent? Rolling hills, green valleys, sand, surf. *Smoke?*

The two aboriginals gazed seaward, nonchalantly observing the arrival of the vessel. Mabo, the elder of the two, casually lobbed another prawn onto the barbecue.

"More boat people, Lionel", he said to his companion. "Your turn to think of something." Lionel rose to the occasion. The ship's masts had jolted his memory. *Radio antennas*, he thought, just like in the brochures!

"Where's that gear the Japanese tourists gave us on the Uluru tour?" He ripped open a discarded cardboard box, pulled out the transceiver and flicked a switch. The Yaesu roared into life.

"Trespassers!" he screamed into the mike. "Depart instantly, or I'll blow you out of the water!"

The message resonated through the ship's communications system, causing general panic amongst the crew.

"Seems to me that any civilisation capable of talking over the waves would have no trouble filling us full of holes, Cap'n", squealed Dick. He recognised high tech when he heard it.

"Dead right, Smithy", replied Cook, his ego suitably deflated. "Let's get the hell out of here!" The intruders slipped away, never to return.

Back from the gulf

They staggered back exhausted
From that long and fateful tramp
To their bitter disappointment
There was no one at the camp.

They found the store of rations
But they really were in strife
For the scarcity of water
Was threatening their life.

If only they'd had a Yaesu
(That wish seems rather strange)
They'd have called the Flying Doctor
For the set has got the range.

Then when they saw the little wings
Approaching in the sky
They'd recognise the flock of pigs
And know they wouldn't die.

So if you're heading outback—
Don't leave anything to fate
For wishful thinking's useless
Take a Yaesu with you, mate!

John Symons,
WOODEND, VIC.

Lionel strolled back to the barbecue. "Job's right, mate. You fix the next invasion."

"Leave it to me, cobber", grinned Mabo. "I've got an idea already."

Our congratulations to Mr Williams for this entry, and we hope he's enjoying his new FRG-100 receiver. Now we present the nine runner-up entries, in no particular order. The first comes from Ms Marigold Robinson, of Nanango in Queensland, and is based on:

Waltzing Matilda

"Thanks Bluey old mate, I'll expect yer pack of dingos shortly, you reckon they're on their way. VK2JSM out."

The old swagman chuckled to himself, as he munched his last mouthful of jumbuck stew, and began washing away the evidence of his crime in the nearby billabong.

He cleverly buried all other traces. Belching loudly, he wished regretfully that he had a cold beer to act as a chaser, but decided it might be best to deal with the Law in a stone cold, sober state of mind.

With deliberate care he tucked his precious FT26 into his tuckerbag to protect it from the outback dust and prying eyes. He was sitting happily under the coolibah tree, humming, and patting the rectangular shape resting in the bag when his "dingo" pack arrived.

Up came the squatters mounted on their thoroughbreds,

Down came the troopers one, two, three,

Where's the jolly jumbuck you've got in your tuckerbag?"

"Troopers you won't find no jumbuck on me!"

Waltzing Matilda, Waltzing Matilda, I'll not come waltzing Matilda with you,

And their ghosts may be heard scratching heads at the billabong,

Moaning "If only we'd had a Yaesu too!"

Little green apples

Adam and Eve were lazing away in the Garden of Eden one day when Adam decided to take a stroll.

"I think I'll see what other delicacies in the fruit line are available to us in the Garden," Adam said, "since we mustn't touch the apple tree or we will become corrupted."

"True," said Eve, "but keep in touch while you're out strolling, and if you find something delectable, just give me a buzz on the old Yaesu and I'll come and join you so we can sample it together."

So armed with his Yaesu, Adam set off. He had been away more than five minutes when he received a call on his Yaesu.

Bullfighting anyone?

In the year 1520 Magellan was very excited when he finally sailed through what is now known as the Strait of Magellan into the vast waters which he named the Pacific Ocean.

Had he had a Yaesu FRG-100 communications receiver, he would have immediately called King Charles in Spain and the conversation would have gone something like this:

"Hello Chucky." (Calling from America this familiarity would have been deemed acceptable). "We have found a passage through America and are about to set sail for the Spice Islands to load up with goodies. Over."

"That is really good news, Magjy. Congratulations. Over."

"Thanks Chucky Boy. I've named the passage Todos Los Santos. We are all a bit weak and hungry and we've lost the San Antonio but we will continue on. Over."

(Now this is where history might have been changed).

"Magjy, before you go to the Spice Islands go more westwards and discover Australia. If the British get there first they will probably only hold it for a century or two. Then imagine the turmoil when some upstart Prime Minister tries to severe all ties and make it a Republic."

"Go and establish a Spanish Colony. Enjoy the climate and the witchetty grubs. Don't miss the Gold Cost and bring me back a boomerang. Over and out."

Now had this conversation actually taken place, bullfighting would have been our national sport and this competiton might have been sponsored by the Juan Lopez Electronique/EA organisations.

Ray Darnell,
RICHMOND HILL, NSW

"Adam! This is Eve calling. I have a visitor here who says we can eat the fruit from the apple tree, and then we will become as powerful as our Maker."

"I'll come immediately," said Adam, and he strolled back to the spot where he had left Eve.

There besides Eve was a long sausage-like creature which slithered around on the ground.

"Oh," said Adam, "it's you. What's this you have been telling Eve?"

"You have been gravely misled about the apple tree," said the Serpent. "You have only to eat one of the apples on it and you will become All-Powerful."

"Are you quite certain about this?" asked Adam.

"As sure as I'm riding this bicycle," said the Serpent.

"I wondered how you were getting around," said Adam, "but if you are so sure of this, why don't you eat an apple and demonstrate its powers to us."

"Oh," said the Serpent, "I'm not really a fruit eater. I wouldn't know how to go about it."

If Adam was nothing else, he was always willing to help other creatures, and thereupon he plucked an apple from the tree and stuffed it into the Serpent's mouth. You could tell that the Serpent didn't like the taste from the expression on its face.

"Are you now All-Powerful, Serpent?" asked Adam, whereupon the Serpent became terribly ill and was sick all over the place, so much so that it turned inside out, dried out rapidly in the sun, and Eve used it forever afterwards as a purse. Adam pondered over this for a while, then said:

"I think we were very lucky there, Eve. If we hadn't had these Yaesus, the human race would forever be doomed as handbags!"

Leonard Ahern,
Canberra, NSW

Some things in life...

Moses staggered to the cliff edge, gazed towards the raging heavens and prayed for a sign. With this, the strange black object which he had mistaken as a small footrest, squawked to life.

"Come in Nile Baby, this is the Big Bad Dude, over."

Startled by his boss's new form, Moses replied; "Oh Lord, guide our lost souls and lead us to salvation."

"Look up the Gregory's if you're that lost, I'm busy. I've got Mohummad on 124.5MHz, the Hari Krishnas are stuck on channel 13 and some bloke called David Coresh keeps yelling 'breaker' at me," replied God in a holy huff.

"But what about the commandments, Lord?" Moses queried.

"Oh yeah, that moral stuff," and so God began.

"Thou shalt not covert thy neighbour's Yaesu. Thou shalt not take thy Lord's call sign in vain. Thou shalt not converse in CB slang and Thou shalt not buy radio gear labelled 'Product of Slovinia."

"Me thinks this is a wise Lord indeed," Moses thought to himself.

"Thou shalt respect thy authorised Yaesu dealer and thou shalt not connect one's unit to high tension power lines to boost power, and then try and claim it on warranty," God continued. "Finally, thou shalt not commit adultery."

"What! Thou art a boring God. There are just some things in life more fun than radio."

"Burn in hell you blasphemous child," God screamed, burying the power meter needle permanently in the red zone.

"Mohummad, you and the Hari's go to channel 5, and David, go and have a barbecue or something. Over and out!"

Craig Urquhart,
West Pymble, NSW

The Yaesu contest

Burke and Wills

The relentless heat pounded on the backs of the explorers. On and on they stumbled. Hunger gnawed at their stomachs. The last of their supplies had run out. All their animals had stumbled and fallen beside their tracks, but perhaps there would be some food at their camp at Cooper's Creek. The flies were getting worse, swarming all over them as they toiled the last few kilometres to the campsite.

At last they were there. Jubilation was quickly turned to horror as they surveyed the bare ground. Only one fire, still warm, showed that there had ever been habitation here. As they realised their terrible fate Wills spotted a tree with but one word written on it: 'DIG'.

The shovels hit something hard. Dirt was dug away, and wiped from the edges. The black metal container was pulled from the bottom of the pit. On closer inspection it was revealed to be a high tech Yaesu. Soon it was all powered up. Across the miles of bush all around the signal raced, all the way to the oasis of civilisation, Melbourne.

The weight on their shoulders and arms pulled them down, down to the ground and then to the hazy sleep of exhaustion. Each of the members soon slumbered peacefully.

The clouds of sleep began to recede as somewhere out in the outside world someone was trying to wake them. Sleep receded to the cries of ... "And who ordered the supreme with extra anchovies?"

Charles Hill,
PEARCE, ACT.

World War 1

JUTLAND, 31st of May 1916, 7.20pm. The dreadnought Battleships of the German High Seas Fleet complete their turn away from the British Grand fleet, and disappear into the smokescreen laid by their destroyers. All that night, while the battleships of the Grand Fleet searched without success for the Germans, the British light forces stayed in contact with the German fleet. Unfortunately, due to the primitive state of communications at the time, only fragmentary reports reached the British Commander in Chief, Admiral Sir John Jellicoe, and the German battleships slipped by him in the dark.

If Admiral Jellicoe had had reliable communications with his light forces, he could have been in position between the Germans and their bases at dawn on the lst June. And that would have been the end of the High Seas Fleet.

The annihilation of their battle fleet would have had a devastating effect on the German people, forcing the Kaiser to sue for peace. If World War I had ended in mid 1916, millions of men would have been saved. Without two more years of casualties and hardships, the peace settlement imposed on Germany would most likely have been much less humilating than that of 1918. It was the perceived harshness of the terms imposed that created the conditions that led to the rise of Adolph Hitler. Also, with the war ending in 1916, and conditions in Russia hopefully improving, the 1917 Russian revolution may never have happened.

The world of 1993 would have been vastly different to what we know today, if only, on 31st May 1916, they'd had a Yaesu!

T.J. Stahlfest-Moller,
Townsville, QLD.

Love will find a way

'O Romeo Romeo! Wherefore art thou Romeo?"

Enter Romeo.

"How comest thou hither Romeo? The orchard walls are high and hard to climb and if thou art caught, thou art history! Thou takes such risks to speak with me — I wish there were an easier way."

"Thy wish I shall grant. I've ripped my best pair of tights climing over the wall and am getting a painfully stiff neck speaking to thou in this fashion. So that we may whisper sweet nothings without fear of discovery I have for thou a Yaesu transceiver."

"O Romeo Romeo! Thou dedication to our love knows no bounds. Is there no limit to thou devotion?"

"Only if thou doth stray within my skip zone, Juliet."

They giggle.

And so their love blossoms and they wed in secrecy. But disaster follows when Juliet is betrothed to Paris and the wedding is planned for the following day. Romeo has been banished from the city, leaving Juliet alone and with no alternative but to fake suicide. A quick call on the Yaesu puts Romeo in the picture.

The family mourn their loss as Juliet lies in a trance on the slab. Finally the vault is closed.

Enter Romeo.

"Awake my sweet Juliet. We must depart and begin our lives anew where none shall stand between us."

Exit Romeo and Juliet.

Thus it came to pass that the tale of Romeo and Juliet ended in jubilation, not tragedy — a triumph of communications made possible by Yaesu.

Leanne Carter,
ORANGE, NSW

Battle of Hastings

The year is 1066. Clashes of steel and the shouts of injured men can be heard close by. Through the mist one can see the noble King Harold of England defending his country against the ferocious Vikings. The victory was in sight. Then suddenly through the din of crashing armour, a crisp clear voice breaks through on King Harold's Yaesu transceiver.

"Breaker, Breaker. His Majesty, copy. Coast Patrol, over."

King Harold picks up the mic of the radio and after a quick conversation replies, "O.K. Coast Patrol, I'll be down to break the Normans' pates, just as soon as I've dealt with these Vikings."

So after sending the Vikings packing, Harold marches down the coast and was just in time to beat the Normans before they could mass their troops.

So ...no Norman conquest ...no King William of England ...no King Henry VIII ...no King George ...no Princess Di ...no Fergie ...no Womens Weekly ...no New Idea and more people reading the intelligent magazine Electronics Australia.

If only they'd had a Yaesu!

Callum Hoogesteger,
GLENORIE, NSW ❖

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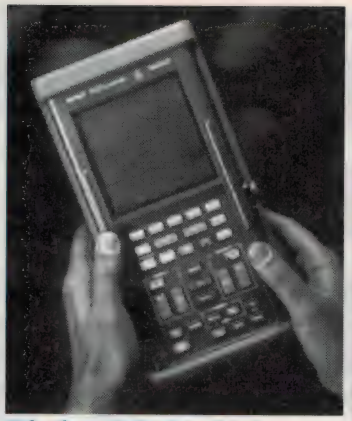

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READER INFO NO. 5

LP WESAT now decodes GMS, supports EGA

In response to requests from readers, Tom Moffat has added some additional features to his Listening Post weather satellite signal decoder package described last year. The software can now decode the signals from GMS geostationary satellites, and can also operate on computers with EGA type video adaptors. Here's a follow-up article from Tom himself, explaining the differences between the GMS and polar orbiting weather satellites.

by TOM MOFFAT, VK7TM

The Listening Post WESAT project described in the June, July, and August 1992 issues of *EA* has been given some major new capabilities. Most significant is the ability to decode pictures from the weather satellites which are in geostationary orbit above the Equator. This feature does not require any changes to the WESAT decoder interface kit; it's all done in software.

The project can now also operate on computers with EGA screens. This feature was put in the too-hard basket for the original WESAT kit release, because I thought there would be little demand for EGA. Well, I was wrong, so as of a couple of months ago EGA has been fully supported by the WESAT project. Again, there are no changes to the hardware side of the kit, just new software.

Actually these features do not involve any changes to the existing software, either; they are simply additions, presented as some more stand-alone .COM programs. The 'enhanced' version of the software is now being included with all kits purchased.

Amiga users, of course, are not getting the IBM EGA software, but the GMS decoding feature is certainly included. As far as I know this makes Listening Post WESAT the only Amiga geostationary satellite decoder produced in Australia.

Existing WESAT users who desire the new features can purchase an upgrade disk, as detailed at the end of this article. Here, now, are the new WESAT capabilities, and what they're good for.

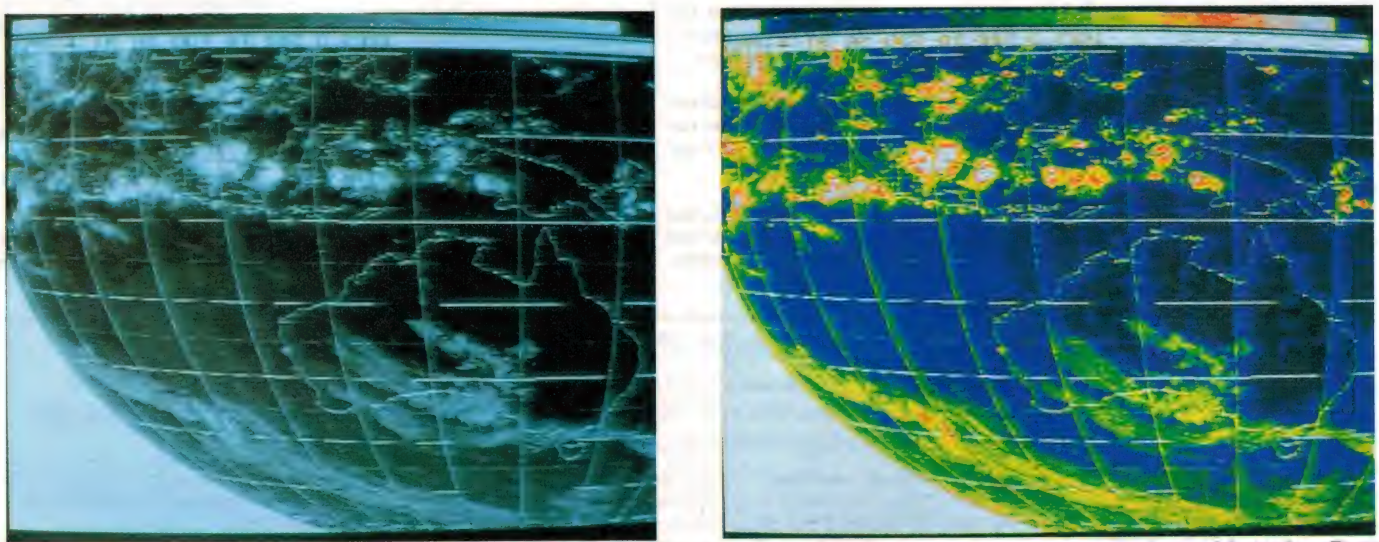
GMS weather pics

The GMS (Geostationary Meteorological Satellite) is a totally different class of weather satellite from the NOAAs and METEORs the Listening Post WESAT project was originally designed to receive. But the decoder itself is fully compatible with GMS standards, since both types of satellites transmit signals based on amplitude modulation of a 2400Hz tone. In fact the WESAT project was designed with future GMS use in mind, and now we have it — thanks to a new software program.

GMS pictures show a great chunk of the earth, photographed from a satellite in stationary orbit 36,000km above the earth. They are a wide angle view of the earth, without a lot of detail. But they show important weather systems on a global scale, and they're 'cooked' by a computer to show continents and latitude and longitude lines, before being transmitted on to the end user.

NOAA and METEOR satellites, on the other hand, operate much closer to the earth, around 600-1000km. Since they are not high enough to orbit in synchronism with the rotation of the earth, they move quite quickly in relation to the earth's surface.

These satellites are in polar orbit, so the earth rotates east-west below them as they move north-south, so they fly over every part of the earth at least once a day.



Photos 1 and 2: At left is a GMS 'C' picture taken from the Australian Maritime College receiver using a Listening Post WESAT decoder (VGA graphics). At right is the same picture 'tarted up' using false colour.

The polar orbiter satellites provide much closer, more detailed images, live to air, but they can't see world-sized weather systems all in one view. So the GMS type and the polar orbiter satellites are both useful, in their own different ways.

GMS-4, the current GMS spacecraft for our area, belongs to Japan. It is in stationary orbit at position 140° East above the equator. GMS-4 is one of a family of five satellites placed at strategic places in fixed orbit. The USA has two called 'GOES', the European Space Agency has Meteosat, and India has a satellite called Insat. The Japanese GMS provides continuous views of our part of the world.

Like the NOAA satellites, GMS produces its pictures from a scanning radiometer. A drum-shaped section of the satellite is made to spin at 100rpm, causing a narrow sensor beam to sweep across the earth's image. At the same time there is a mirror that steps the beam down a fraction of a degree for each horizontal scan, so the result is a scanned image like a television picture. Atop the spinning drum is a 'de-spun' section carrying directional antennas.

The initial scanned image is not intended for the end user. Instead it is sent to Japan, where it is processed into the kind of picture you see on television every night. Lines of longitude and latitude are drawn in, as are continental boundaries. The picture is then sent back up to the GMS, from where it is re-transmitted to the end user.

According to the *GMS Users' Guide* the processed images contain exactly 16 levels of gray-scale; no more, no less. This is an exact match for the capabilities of the Listening Post WESAT decoder. Some other satellite receivers advertise '256 levels of gray', but the actual incoming image still contains only 16 shades. So in answer to those people who have asked when we are going to increase WESAT to 256 gray levels, we aren't — because there would be no purpose; no improvement in picture quality.

Although the whole earth is scanned from the GMS's point of view, the image is broken up into four overlapping quadrants and processed as four weatherfax images. These are designated the A, B, C, and D pictures. The A and B are of the Northern Hemisphere; the C and D are to the south giving useful views of Australia and New Zealand. For Australia the C picture is particularly useful, because it shows all of the continent in one go, as well as a big area to the west and south where most of our weather comes from.

Photo 1 is a C picture, as received by Listening Post WESAT and displayed on a VGA computer monitor.

Larry Piper, a climatologist with the Australian Maritime College, shows a GMS 'C' picture in his lab at the AMC.

Photo 2 is the same thing with false colour added. The picture looks pretty tame weather-wise, with some cloud over the southern part of Australia and a long, horizontal front stretching along the Bight and through Bass Strait. There was no sign of this cloud at all in Tasmania, as evidenced in the nice blue sky in the photo of the dish.

But the next day all hell broke loose, with record floods in South Australia, Victoria, and Tasmania. Most of that would have been caused by that big front lying far to the south-west. It stands out in brilliant green in the false colour picture. The four sectorised pictures, by the way, are scanned in the infra-red, so the false colour is an indication of cloud temperatures.

GMS also provides some polar-stereographic pictures — called H, I, and J — which appear to look down on the earth from a northern point of view. These images, corresponding to visual wave lengths and infra-red, are useful for observing typhoons.

The GMS images

Let's take a closer look at the structure of a GMS pictures. The first thing to come along is a 'blurt' sound which tells the facsimile recorder to start receiving. This is followed by phasing pulses, just like on HF weatherfax, which get the edge of the image lined up with the edge of the screen.

You don't see these pulses on the screen image, because the WESAT decoding software doesn't let anything appear on the screen until all the phasing pulses have finished.

The first image that appears on the screen is a burst of binary data which identifies the picture. Next is a 16-step gray scale for setting the correct audio (brightness) level for the decoder. Then comes a visual identification label showing the time and date, the type of picture (A, B, C, etc) and whether it is visual or IR. And after all that comes the picture itself.

Every picture is exactly 800 lines long, measured from the end of the phasing pulses. Scanning is at four lines a second, twice as fast as HF weatherfax, NOAA or METEOR pictures. So one picture takes 200 seconds to transmit. Unlike polar orbiters, transmission from the GMS to the end user is not continuous. Usually every three hours there is a transmission of a series of pictures, starting with a couple of polar stereographic views and then the A, B, C, and D pictures. Sometimes there are more, but usually it is safe to assume that the whole transmission will fit on one side of a C60 cassette.

Operation with the Listening Post Wesat software is mostly automatic. The transmitter rests for a minute or so between each picture, so when you run the program it sits there waiting for the phasing pulses.

When the pulses have passed the picture begins painting onto the screen. Reception stops automatically at the end of the picture, after which you can flip it upside down, look at it in false colour, and finally save it to disk. By the time

you've done this and started the program again, it will be just about time for the next picture to appear on the tape. An entire transmission of GMS pictures can be stored on one 1.2M floppy in the case of IBM compatible PCs, or on one 800K disk for Amiga.

Receiving transmissions from the GMS satellite is somewhat more difficult than snaring signals from the low-altitude polar orbiting satellites. GMS transmits on 1691MHz, more than 10 times higher than the polar orbiters. And the signals must travel at least 36,000km to earth, compared to the 3000km or so for polar orbiter signals at their furthest range. So the signal to be worked with is *tiny*. Still, practical use of GMS isn't out of the question for the home experimenter.

The GMS scheme of things allows for a class of user called 'Small-scale Data Utilisation Station', or SDUS. Read that as 'cheapskate special'; that is, you and me. An SDUS station has to be a pretty good performer, but not 'amazing'. For instance the *GMS Users' Guide* says a SDUS receiver should have a noise figure at 1691MHz of 3.4dB or less. This shouldn't be too hard for a home constructor to achieve with modern semiconductors.

The book says antenna gain should be 30dB or more. This suggests that a dish might be required, but there are lots of stations all over the world using various forms of high-gain Yagi antennas. At 1691MHz you can get a lot of elements on a short boom.

The usual arrangement is to feed the antenna into a downconverter, from 1691MHz down to 137.5MHz where the NOAAs and METEORs live. From then on you can use your normal WESAT receiving setup, recording the output of the receiver onto cassette for later decoding. The receiver should have a bandwidth of 250kHz, but most receivers with a 'WIDE FM' mode should handle this all right.

I visited the Australian Maritime College in Launceston, to see how one educational institution has established a weather satellite receiving station. The AMC uses both polar orbiter and GMS satellite pictures to train future ships' deck officers to read the clouds from above, as well as below. This is considered an essential part of modern seamanship.

For GMS reception the college has a 2.6m dish (Photo 3) mounted on top of a small hut, which in turn is situated on the roof of the college.

Photo 3: The 2.6-metre dish on top of the Australian Maritime College. The cylindrical antenna on the left is a 'vertical helix', for receiving NOAA and Meteor signals.

Co-axial cable leads from the dish several metres down into the hut, where a 1691 to 137.5MHz downconverter is fixed to a wall. The output of converter feeds to a lengthy run of coax that goes to the marine climatology lab in the building below. Within the lab, climatologist Larry Piper presides over a fine collection of weather-related electronic gear (Photo 4). Below the TV monitor is a 'Feedback' weather satellite receiver model WSR513.

The flat instrument below Larry's right elbow is an Alden model 9331 telemetry receiver set up for the satellite frequencies. It also has switchable bandwidths of 26, 40, and 200kHz.

The 'Feedback' receiver can produce pictures on a video monitor without the help of an external computer . Signals can also be sent to a mechanical facsimile machine. On the shelf above the fax machine are rolls and rolls of old pictures it has produced. Larry is holding a giant 'C' picture from the mechanical fax machine.

Incoming pictures can also be recorded on a large Akai reel-to-reel tape recorder. The gadget on top of the recorder is a wind speed and direction indicator, which has nothing to do with weather satellites.

The satellite photos for this article were received via the Alden telemetry receiver. Its audio output was connected to the line input of a Sony professional mono cassette recorder (a new acquisition of mine) and the resulting tapes were played into a Listening Post WESAT decoder.

Sharp-eyed readers would have picked up a weak spot in the AMC's receiving system. It's the long length of coax between the feed horn on the dish and the input of the 1691MHz converter. There is some noise on incoming pictures, and my guess is that it would disappear if the 1691MHz converter could be located right under the dish. There's a good spot for a waterproof box, right behind the legs supporting the dish. This would of course require a longer 137MHz cable, but any losses in this cable would probably be made up by gain within the converter.

For your own GMS system it is possible to purchase a ready-made 1691 to 137.5MHz converter from the USA for about US$500. But it should be easy enough to roll your own. It might be possible to adapt an amateur radio design for 1296 or 2304MHz; these are published in various handbooks. As for the antenna, a dish is nice but a Yagi of some sort could very well do the trick, especially in northern parts of Australia that are closer to the satellite.

WESAT and EGA

The original WESAT project did not support EGA graphics, only CGA and VGA. CGA is a low-resolution picture standard which was included primarily for laptop computer users. The VGA standard is capable of full analog gray-scale and false colour performance, and it produces on-screen satellite pictures of excellent quality.

As for EGA, it is a digital system — its colours are either full on, half on, or off. In its native form EGA's colours are quite unpleasantly garish, and gray-scale is nonexistent. So I decided in the first instance to do away with EGA, rather than to present an EGA system that produced satellite pictures only in yucky false colours, and not at all in black and white.

Now, after many requests from potential users, Listening Post WESAT supports EGA. This took a lot of fiddling with the EGA colour control system, but the picture results are very acceptable. In false-colour mode there are 16 colours, in shades very close to those of the VGA and Amiga pictures.

And gray-scale pictures are now available in four shades. This doesn't sound like much, but in practice they look pretty good — at least the people at the Australian Maritime College think so.

The EGA system uses six colour control lines to the monitor, two each for the red, green, and blue electron guns. Each gun has a 'bright' control line and a 'dim' control line, each of which can be switched on or off.

So if you turn on the 'dim red' line, the screen lights up dim red. If you turn the dim line back off and then turn on the 'bright red' line, you get bright red. But if you turn them both on at once, you get bright+dim = very bright red. Or if you turn them both *off*, you get nothing — black. The same four levels — nothing, dim, bright, and very bright — also apply to the blue and green guns.

If you consider each of the control lines to be a binary digit, then there are six bits or 64 different colours that can be produced by mixing the various strengths of red, green, and blue. But only sixteen of these colours can be displayed at any one time. Each of the sixteen colours is set up by six bits in an eight-bit 'palette register' in the EGA video card. The other two bits are unused.

When the WESAT interface is decoding satellite pictures, it tells the computer that each picture dot should be one of 16 levels of brightness (0 - 15), and that value corresponds directly with one of the sixteen palette registers. So if a pixel of brightness '4' comes in, the decoding program simply tells the computer to set the dot on the screen according to the contents of palette register '4'. Had I wished any dot of value '4' to be yellow for instance, I would have previously set up register four so that its bright red and bright green bits were on, and everything else was off. All the palette registers are programmed with custom-made colours when the program starts.

With that in mind, consider the EGA gray-scale problem. To get white on a colour television screen, red, blue, and green must be present in equal amounts. Gray is low intensity white, so red, green, and blue must still be equal, although less strong. So only four gray shades are possible. If we turn on both the bright and dim lines of all three colours, we get the whitest, brilliant white. If we turn on the bright lines, but kill the dim lines of all three, we get bright gray. If we again turn on the dims, but kill the brights, we get dim gray. And if we turn off both brights and dims for all three colours (everything off), we get black.

So to program the sixteen palette registers to produce a gray scale of four levels — black, dark gray, light gray, and white, we set up the lowest four palette registers with all bits off, the next four registers with all three dims on, the next four with the dims off but all brights on, and the last four registers with all dims and all brights on.

To work out the false colour values I wrote a program that produced a display of 16 television-style vertical colour bars on the screen, one for each palette register. I laid out the data area of the program with a bank of ones and zeros, little switches to turn the guns on and off. I then went through and meticulously fiddled with the switches in each register, trying to make it match a similar bar display of the standard WESAT colours on a VGA screen.

It's not easy to squeeze pastel shades of blue and green out of a system that works with on/off switches, but I learned little tricks such as mixing a little dollop of white behind a blue to make it look dimmer, when in fact it was really brighter. It took a whole evening to produce a presentable set of EGA colours, by squirting little dabs of red, green, and blue into the 16 registers. It's clear now why the call them palette registers.

The two resulting tables of gray-scale and false-colour values now live an the data areas of the EGA WESAT programs; you can select one or the other with the F1 key in the same manner as with VGA. This new EGA software for all the satellites, including GMS, is included with the new WESAT release.

Meteor update

Most Wesat users have discovered by now that Russian METEOR weather satellites are few and far between. When the WESAT kit first appeared in June last year, many Meteor satellites were active, giving several useful passes a day. But since the collapse of the former Soviet Union, and the resulting economic problems, the Russian space effort has suffered badly.

By now most people have heard the sad tale of the cosmonaut who was stuck orbiting in a spacecraft for several weeks, because the Russians didn't have enough money to bring him down. Well, the METEOR weather satellite program has been badly cut back too.

At last report the Russians had de-activated all but one of the satellites. Until November 3 last year the newest satellite, MET-3/5, was operating alone. As of November 3 they de-activated MET-3/5 and replaced it with our old friend MET-3/4, the one that gave us all those lovely cloud pictures in the *EA* articles.

MET-3/4 uses a scanning system in which its audio tone frequency of 2400Hz is locked to the picture scanning rate of two lines a second, so that each scan line consists of exactly 1200 cycles of tone. Listening Post WESAT takes advantage of this to produce its high-quality pictures. But MET-3/5 uses the earlier scanning system in which the tone frequency is not locked to the scan rate, so the original WESAT software cannot properly decode these pictures.

I am now developing some new software that senses the sync pulses at the start of each MET-3/5 picture line.

As this is being written we don't know if the Russians intend to bring MET-3/5 back into operation, or whether they intend to stick with the higher-performance MET-3/4.

There is a chance they'll just say 'to hell with it' and turn the whole lot of them off. This wouldn't be a total surprise, because it's reported that the Russian scientists in Antarctica are no longer receiving logistic support from home, and in fact they're not even being paid. Consequently they have gone on strike. Unofficially, it's likely the Russians are still doing their work in Antarctica, but they're refusing to send back the results. Much of the work, especially climatological studies, depends on their polar orbiting satellites. There's every chance the satellites could be

Continued on page 88

The incredible Silicon Graphics success story:

LEADING THE WAY TO A 3-D GRAPHICS FUTURE

US 'visual computer' maker Silicon Graphics Inc made the news twice recently — once for being praised by President Bill Clinton as a model for US high-tech industry, and then for creating the impressive special effects in Steven Spielberg's movie *Jurassic Park*. Here's an insight into the factors behind SGI's almost explosive growth, and why it seems ideally placed to exploit the coming 'multimedia revolution'.

by BOB FROST

"I have a theory about entrepreneurs," says James Clark, the founder and chairman of Silicon Graphics, sitting in his modest office. Clark, 49, blond and pale skinned, has a typical California 'laid-back' veneer that barely covers his marked qualities of precision, intensity and restlessness. He has parlayed a reputation for technical brilliance, foresight and vision into a personal fortune estimated at some US$27 million.

"I believe," says Clark, "that most entrepreneurs come from unsettled roots — from some situation that they're earnestly trying to get away from."

Clark comes from the west Texas town of Plainview, which had a population of about 15,000 when he was growing up in the 1940's and 50's, and is situated in the state's panhandle between Lubbock and Amarillo.

It's semi-arid country, where dry winds blow in from the Western desert; it's hot as a pistol in the summer, and the terrain is limitless flat grey plain.

"It was black-and-white," Clark says. "So when you come from a place like that, and from a family with very modest financial means — you might even say, almost poverty, although we weren't really in poverty — it was just a struggle."

Clark's father left the family scene quite early, and the children were raised by his mother. Jim, the middle child, was good at maths and liked tinkering with ham radios and his '55 Ford. Neither his brother or sister would graduate from high school. Jim, a very bright boy in a school system that didn't stimulate him, rebelled in relatively minor ways. He got suspended from high school several times, for such pranks as trying to take whisky along on a school band trip. Ultimately, in his junior year, he 'smarted off' to an English teacher, and was asked to leave school until the next school board meeting, when a vote would be taken about whether to let him back in. He decided at that point that he was fed up with Plainview, and in 1961 joined the Navy.

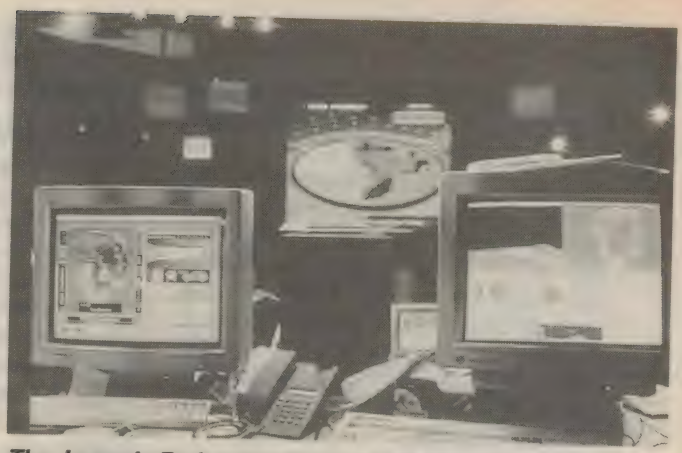
At left is SGI's president and CEO Edward McCracken, with company founder and chairman James Clark on the right. President Clinton has praised their company for its success in high technology.

While attending Navy enlisted man's school, Clark realised he had significant technical ability. He studied in the field of interior communications — alarm systems on ships, amplifiers, gyroscopes and the like. "People were tracking how we did in school, and I was coming out on top all the time," he says. "So I thought: Hey, this is fun — I never came out on top of anything before."

He was assigned to duty on a ship based at New Orleans, started night school at Tulane University and finished first in his class in freshman maths. He also got A's in calculus and English, and was excited about academics for the first time in his life. Upon leaving the Navy in 1964 he enrolled full time at Tulane and also worked full time at Boeing.

The tumult of the 60's had no impact on him whatsoever — "I was so heads down, so focused on getting a degree; I wanted to be a professor and I just focused everything on that." While pulling his master's in physics at LSU in 1971 he read an article in *Physics Today* that said that 50% of recent physics PhD's didn't like the jobs they

Actress Ariana Richards learns to use the Silicon Graphics system from graphics supervisor Michael Backes, while director Steven Spielberg (right) looks on.



The Jurassic Park control room as it appears in the movie,showing the SGI workstations.

ended up in. "So I said 'Forget this. I'm going to get into computer science. That's a new field, not many people are in it, and it's going to be big.' I wanted to make a difference in the field I got into."

Clark went to the University of Utah for his PhD in computer science, because of its pioneering program in computer graphics. He quickly became the star pupil of the father of interactive computer graphics, Ivan Sutherland.,In 1962, for his doctoral project at MIT's Lincoln Laboratory, Sutherland had created 'Sketchpad', a program that allowed him to use a light pen to make engineering drawings of the computer screen.

The program had windows and icons. It was a wholly new way of interacting with the computer. Computer pioneer Alan Kay once described Sutherland's concept as 'a glimpse of heaven ... a light showing us the way to friendlier, more usable machines."

Clark wound up at Stanford in 1979 as an assistant professor of computer science. He felt desperate. He wanted to be a professor of the first rank, and felt that he was not on the fast track to that goal. He was in his mid-30's and felt he had wasted too much of his life. To make up for lost time, he was 'manic' in his focus on work at Stanford — almost a white hot intensity," he said.

His wife left him because of his workaholism. He laboured non-stop on a logic design course that he had never taught before, and also on his Geometry Engine — a complex, brilliant piece of computer hardware, funded by the Department of Defense, that would later be patented and become the fundamental pillar of Silicon Graphics.

'Some weird thing'

"My passion was to make computer graphics cheap," Clark recalls. "I was damn tired of having to pay a lot of money for high performance computer graphics. I learned how to design chips and I thought, 'I now know how to design chips, so I'm going to revolutionise this whole area of computer graphics.' Because guys like Evans & Sutherland (a Utah-based firm co-founded by Ivan Sutherland) were just sitting around creaming the market with their expensive machines."

Meanwhile at Stanford, graduate student Andreas Bechtolsheim was creating the Unix-based SUN terminal that would launch Sun Microsystems in 1982. SUN originally stood for Stanford University Network. The machine did two dimensional graphics. Clark, down the hall, was more interested in three dimensional, real time machines.

"Most people just kind of looked at me, " Clark says, "and said, 'Ah, he's working on some weird thing over there'."

But not everyone. Clark attracted several able colleagues, bright young men in their 20's with whom he would later found SGI.

Most of these founders are still with the company today after more than 10 years — a rare phenomenon indeed in Silicon Valley, where there's a long tradition of heading out the door to start your own shop.

This continuity is a fundamental component of SGI's continuing success, observers say. Losing half a dozen key people is probably one of the few things that could hinder the firm in its march toward being a very big deal.

SGI formed

Clark's group worked on final versions of their graphics technology in 1980, and began talking more about starting a company; in October 1981, Silicon Graphics Systems was incorporated. Later that fall, Clark paid visits to big computer companies to try to sell Geometry Engines to them — IBM DEC, Hewlett-Packard, Apollo and others.

"Not a single company understood the impact of what I was talking about, " Clark says. "They all said, We don't need that. We've got graphics." Most of them said, 'We don't think there's a market for three dimensional computer graphics.' So I came back and said to our guys, 'Why don't we do it all ourselves?"

Apollo chairman Thomas Vanderslice, based in Massachusetts, was quoted at about this time saying of SUN, with whom he was locked in dire competition, "In this country, everything loose rolls to the West Coast." Apollo no longer exists as an independent company, while SUN had revenues of US$3.6 billion in fiscal '92.

In June 1982, Silicon Graphics got $800,000 in seed money from the Mayfield Fund, a venture capital firm in Menlo Park, in exchange for 40% of the company. In 1984, as SGI expanded into the workstation market, Mayfield people helped the company identify and recruit Ed McCracken, then with Hewlett-Packard, as president and CEO.

More than one observer regards McCracken as the best CEO in Silicon Valley today. "I have known many company heads in the computer business." says Richard Mark Friedhoff, president of Visicom. "I think Ed is probably the best one around today."

960 times the power

The first Silicon Graphics workstation, in 1984, sold for US$80,000 and had a computing speed of 0.3MIPS (million instructions per second). Today, an SGI machine selling for US$10,000 cruises along at 40MIPS — an improvement in the price/performance ratio by a factor of 960.

"What we'll have by the turn of the century," says Richard A. Shaffer, editor

of *Computer Letter*, "is supercomputer performance in a box that sells for less than the cost of a colour TV."

Today, graphics computers like Silicon Graphics' machines are still a small subset of the world's US$10 billion to $15 billion workstation market, and today have only 8.6% of total workstation sales (measured by revenue), according to International Data Corp. The company is dwarfed by workstation leader SUN Microsystems, which has 33% of the market.

Gaining strength

But SGI has expanded its line lately to include moderately priced machines selling for US$7000 - $10,000. It's gaining market share at the expense of SUN — primarily because of its greater graphics capability, according to technology analyst Robert Herwick of Hambrecht & Quist. Its 8.6% share in 1992 was up from 6.5% the year before.

SGI's work force today is 3700, up from 605 in 1987. It is the eighth fastest growing company in Silicon Valley and, on a percentage basis, the most profitable computer company in the valley. And, perhaps most important, it's universally regarded as the leader in visual computing know-how. "Every engineer would kill for an SGI machine," says Shaffer.

"For a lot of people," says Herwick, "Silicon Graphics will define the workstation of the future. To the extent that that happens, I assume the other vendors will get into a catch-up mode. SGI's machines have been perceived by some people as 'that graphics workstation in the corner.' Today they are increasingly becoming the primary workstation environment in a lot of major companies."

To change the world?

There are those who think what Silicon Graphics is doing could change the world. No one at SGI talks that way — not to reporters, anyway — but others do. Like Richard Mark Friedhoff, president of Visicom Corp., a computing/communications consulting firm in Los Angeles. "It is visual computing, rather than ordinary computing that is going to bring the power of computing into virtually every field of human endeavour," Friedhoff says.

"When you take the tremendously visual quality of human thinking and join it with a visual computer, you create a whole new way of thinking, of imaging things and of doing things. I believe that it is not overstating the case to say that the visual computing revolution will be as dramatic in its overall impact on the way we work and entertain ourselves as the computing revolution itself."

US$10 billion goal

Silicon Graphics today is a US$1 billion company that sells about 30,000 computer systems a year to the workplace. In five to 10 years, it would like to be a US$10 billion company that's a major player in the mass market place. It has high hopes of becoming a power centre in a huge new industry — an industry that can be viewed, in part, as an aspect of the visual computing revolution: digital media.

Digital media, also known as digital multimedia, or just 'multimedia', refers to the digitisation, the computerisation of images and sounds. Compact discs play digitised music, and in all likelihood, high definition television will transmit digitised images.

'No market for 3-D graphics'

When Silicon Graphics founder Jim Clark visited the big computer companies in 1981, trying to interest them in his 3-D video graphics 'Geometry Engine', the answer he got from firms like IBM, Hewlett-Packard and DEC was:

"We don't think there's a market for three-dimensional computer graphics".

So Clark and his colleagues decided to develop the idea themselves. Twelve years later SGI is a US$1 billion company, selling about 30,000 systems and well placed to take a leading role in the huge emerging multimedia market.

The very phrase 'digital media' makes the financial world lick its chops. Also the television world, and the worlds of telecommunications and computers. "Multimedia systems," writes media scholar John Waterworth, "will have an impact on daily life more than equivalent to that of the introduction of telephones, television, and computer games combined into one."

The heart of this brave new world will be a media super highway, carrying as many as 500 information channels into homes and businesses, largely via fibre-optic cable and satellite. The system will be interactive. People will be able to order stuff from it — and will therefore transform us into what we've been destined to become since the first Sears Roebuck catalog was issued in 1888: perfect consumers, able to instantly buy almost anything we want.

Movies from *Casablanca* to the very latest Hollywood hit will be on tap whenever we want them, without our having to go to the video store. Also a fresh copy of 'Abbey Road' or the new Janet Jackson album; the new Norman Mailer novel; the latest issue of the New York Times or an issue from 20 years ago; the hottest computer game; an X-rated virtual reality environment to plunge our pink bodies into; a text/video/animated/musical tour of Nashville; a custom-edited compilation from The *Ed Sullivan Show* that reflects our passion for Topo Gigio, food, custom fitted clothing and cubic zirconium rings from home shopping stations; the entire contents of the Library of Congress; information from our place of employment that allows us to work at home; and live video transmissions of games played by our favourite teams...

Telephone services, including video phones, will be integrated into this awesome net, this cyberspace, this 'infospace', into which we'll happily crawl for hours on end. There will be endless stuff — 500 channels and always something on, as long as we're willing and able to pay for it.

As digital media super highways to the home are built by consortiums of cable TV, telephone and entertainment companies over the next few years (a prototype is scheduled to open by the end of the year in Orlando, Florida), certain technologies will be required to store the endless stuff and reproduce it interactively on screens in our home. Silicon Graphics is expert in these particular technologies and recently teamed up with Time Warner, America's second largest cable TV firm, to develop a 'super data highway server'.

SGI will, of course, face formidable competition from other high-tech companies, but there's a big pie to slice up. "There are billions of dollars here," says analyst Robert Herwick.

Survival plan

And there's more in sight. Jim Clark envisions using SGI technology to help create the 'Telecomputer', a low cost, easily portable computer, with a crisp, high resolution screen, that displays all of this stuff in the home and allows for fun-related computing activities as well.

"The computer company that sells powerful low cost products to the consumer market," Clark says in his office at SGI, "is going to be the surviving computer company. That's the way the technology moves — down market. The technology leaves the dinosaurs behind. You don't want to let yourself get extinct. All along the way, in the next few years, there are going to be new dinosaurs." ❖

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When I Think Back...

by Neville Williams

An Unsung Pioneer: W.E. Coxon of WA — WIA and AIM supporter, co-founder of 6WF

This month, prompted by a one-time Western Australian reader, we outline the career of a pioneer whose name has not featured widely in the Sydney/Melbourne based industry press: WA wireless enthusiast Walter E. Coxon. While his contemporaries Ernest Fisk and Raymond Allsop were making wireless history on the east coast, 'Wally' Coxon was doing his considerable best to get public broadcasting to air in his home state.

It may well be said that this article on W.E. Coxon is running behind time by at least 26 years. Way back in October 1967, a Mr Adrian M. Peterson of St Lucia, WA wrote to me as the then-editor of *EA* enclosing an article on Walter Coxon who, he said, had made no less valuable a contribution to the establishment of wireless in Western Australia than had his more widely publicised contemporaries on the eastern seaboard.

What prompted the letter was the fact that Walter Coxon had been issued with an Australian amateur operator's licence just 60 years before, in 1907. Adrian Peterson had arranged to interview him in recognition of his wireless/radio 'diamond anniversary'!

At the time, as the file shows, I was at a loss to know how best to accommodate Mr Peterson's article. There were no supporting illustrations, and a further concern was that an isolated personal story about a little-known pioneer might appear somewhat out of context in the magazine format then current.

After all, back in the 1960's, pioneers and old-timers were still an integral part of the everyday electronic scene. Any number of them were involved full-time in the industry, as company proprietors and/or directors, managers, engineers, technical writers, production supervisors — right through to practising servicemen and retailers. Veterans for sure — but scarcely venerable at that stage!

Since then, that whole generation of old-timers has withdrawn into the relative obscurity of retirement — transformed into a valuable though vulnerable repository of electronics history.

Within the same time frame, a great deal of one-time local expertise has been retired with them, to be replaced by a radically different kind of technology: much of it based off-shore, less accessible and increasingly more difficult to explain in plain English.

So, while many technically inclined readers rely, of necessity, on imported, mass-produced solid-state whatnots for what they hear, see and do, they gain vicarious pleasure from reflecting on what they can better relate to — the processes and the people who brought basic electronics into being.

Hence the 'Think Back' series including such figureheads as: Father Shaw, Sir Ernest Fisk, Raymond Allsop, Sir Charles Kingsford-Smith and the *Southern Cross*, Ron Bell and RCS, Fred Thom and Tasma, Leslie Bean and Stromberg-Carlson, Murray Stevenson and 2UE/ATN, Charles Slade and Calstan — and now, as part of that overall scene, Walter Coxon.

Wireless Institute of Australia: WA Division

The first 1921 meeting of this division was held in the Science Rooms, James St, Perth on Thursday March 3, Mr W.E. Coxon presiding over a large attendance.

He informed members that the Dept intended disposing of a quantity of apparatus by tender early in March. A motion was moved to the effect that the Govt Stores Dept be written to, requesting them to sell this material by auction.

The secretary reported that membership badges were now available from WIA Headquarters.

Mr Turnbull (assistant secretary) presented a list of registered amateur stations in the state and promised to make the necessary additions each month. The Institute has set itself the task of collecting complete data concerning the apparatus possessed by every amateur in the state and, with this object in view, responsible experimenters are being communicated with.

(From 'Sea, Land & Air', April 1, 1921)

At last, Walter Coxon

Having, as a young man, qualified for his amateur wireless licence in 1907, it seems likely that 'Wally' Coxon would have been born in the late 1880's. This puts him as a contemporary of Ernest Fisk (see *EA*, June 1989) and a few years ahead of Raymond Allsop (*EA*, January 1990).

Interviewed by Adrian Peterson in 1967, Wally recalled how, as a youth, his favourite hobby had been building gadgets and working models of one kind and another. As it turned out, the project that ultimately shaped his career was the construction of a wireless receiving set, as featured in the English magazine *How To Make It*.

The project involved winding what Wally described as 'a great length' of waxed bell wire on to an 18" (46cm) length of wood, of cross-section 2" (5cm) square. A sliding contact supported by a steel 'ramrod' was called for, which presented him with quite a problem in keeping the exposed track along the winding free from wax. The adjustable coil and a few other bits and pieces added up to a receiver, ostensibly ready to 'listen in'. Only then did he realise that there were no transmitting stations in Western Australia; so he set

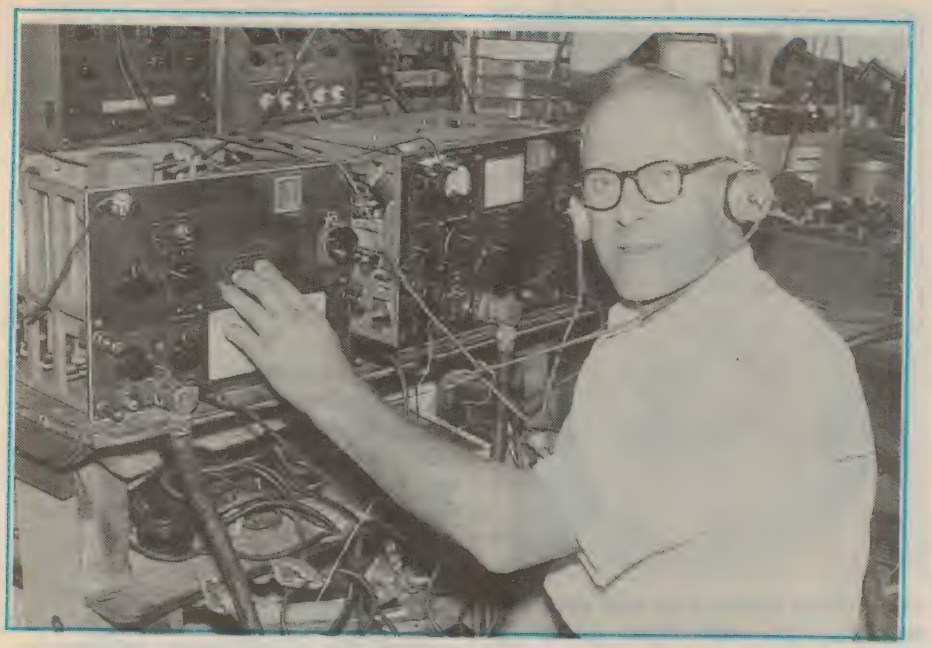


Fig.3: Wally Coxon shown at the operating position of his amateur station VK6AE in Darlington WA, in 1960. The 'rig' and associated test equipment is a far cry from what is indicated in Fig.1.

about building one himself — again in his home at Maylands.

As transmitters go, it was every bit as primitive as his receiver (Fig.1) comprising a coil and condenser, an oscillation transformer, an electrical spark gap and presumably an aerial of sorts. (For a discussion of early transmitters see 'From sparks and arcs to solid-state' in *EA* for Oct-Nov-Dec 1990).

Elementary though it undoubtedly was, Wally's transmitter worked and radiated a signal from one suburb of Perth, which was duly picked up in another. The year was 1907. As far as Wally could determine, it was the first ever land-based wireless/radio contact in Western Australia.

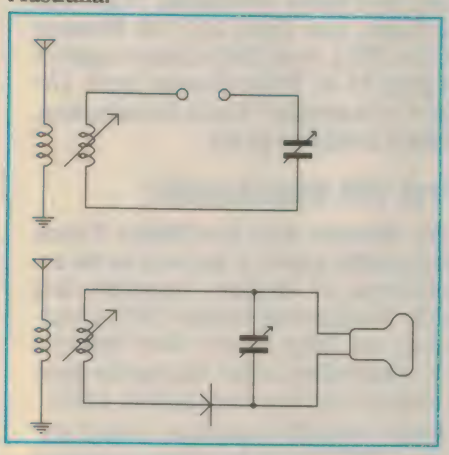


Fig.1: According to Wally Coxon's amateur licence renewal issued by the Department (Jan 6, 1914), circuits as above were supposed to represent a transmitter and receiver. As they stand, they are virtually meaningless.

Early WA stations

The Battye Library in Perth, specialising in Western Australian history, holds a periodic renewal dated January 6, 1914 for the original transmission licence issued to Walter Coxon, call-sign XYK.

Details of the transmitter covered by the document were listed as: oscillation transformer, tuning coil, variable condenser, spark gap. A listing for the associated receiver read: loose coupler, condensers, galena and electrolytic detectors, telephones.

According to Wally Coxon, one of his early spark transmitters was built around the 'trembler' coil from a model-T Ford car, a series which, according to the 1935 *Modern World* encyclopedia, was current from 1909 to 1926. (I vaguely remember the spark coil involved in Ford's ignition-start routine but, for we kids at the time, the real prize from a model-T were V-magnets from the flywheel assembly used to pulse Ford's version of a magneto!)

During the interview Adrian Peterson says that, 'with a twinkle in his eye', an ageing but still active Wally Coxon rambled on without pretension about other interesting aspects of wireless/radio in those very early days, before World War I.

Between 1907 and 1914, he said, quite a few other hobbyists 'caught the wireless bug' and were allocated callsigns beginning with the letter 'X' to signify 'experimental' — plus the applicant's initials. How his own came to be XYK, he had no idea!

In 1912, four experimenters in his neighbourhood joined with Wally to found what became the nucleus of the WA Radio Club (Fig.2). Its numbers were swollen by the formation of similar small groups in other suburbs of Perth.

Wally recalled that, in the international political climate of the day, there were considerable misgivings in the community about such informal wireless activities, involving as they did, unsupervised 'conversations ' in Morse code and the apparent scope for clandestine transmissions.

Official stations

Over and above the amateur activities, official stations also appeared on the air, including POS and POP, both operated by the PMG Department.

Located in Sydney, POS derived its rather strange callsign from 'Post Office Sydney'. The even stranger POP signified 'Post Office Perth'. POP was housed in a hilltop radio complex at Applecross, with its then powerful signal blasting into the ether from a 400ft (122m) mast supported on glass insulators. POP was subsequently re-christened VIP, and inherited the responsibility for contacting ships entering coastal waters off WA.

Using the callsign XNG, VIP also used to transmit standard time signals for the benefit of passing ships. As a cross-check on its accuracy, XNG had a standing arrangement for a similar station in the UK to transmit a time check each evening at 9.00pm (WA time). XNG's clock would be checked against this and against stellar readings.

As the procedures were refined, a discrepancy became apparent. The answer was simple, even if unexpected: XNG at Applecross was sited 220 yards (202m) from where it was supposed to be, according to Admiralty charts — which had to be corrected forthwith!

Mention of VIP reminded Wally Coxon of another memorable occasion when the station staff itself, got it wrong. By chance, he and another amateur by the name of Sibley came across a newspaper from Java. They took a section each and agreed to use it for mutual Morse practice

Fig.2: Evidencing the ravages of time, a document stamp from the original WA Radio Club, founded in 1912.

— the idea being that, by using a foreign language, they would be less inclined to identify missed letters and words by context.

Intruders? Spies?

They certainly got their Morse practice, but there was one hitch: the ship-to-shore establishment at Applecross issued an official statement to the effect that Dutch operated (spark) stations in Java were interfering with shipping communication in Western Australian waters!

Other official stations, set up mostly for communication purposes in WA, included VIN at Geraldton, with others at Carnarvon, Roebourne and elsewhere. VIW at Wyndham was established initially to coordinate the movement of cattle to markets in the south. It was later taken over as part of the coastal radio service.

When war was declared in 1914, the authorities translated community misgivings about amateur wireless activities into a complete clamp-down. Wireless enthusiasts were requested to dismantle and surrender all radio equipment and to take down all radio masts. In fact, the military were so touchy about security that they even banned the sale of press-button operated torches, in case they were used to communicate clandestine messages in Morse code!

Some members of the public excelled themselves in 'dobbing in' possible offenders. On one occasion, a complaint was lodged that flashes of Morse code had been observed from a radio aerial erected at Mr Coxon's home. A full official investigation revealed that the aerial 'mast' was an ordinary flagpole and that the flashing Morse code was simply moonlight reflecting from a weather vane oscillating in the breeze.

Fig.5: Wally Coxon was also involved with the Rev. John Flynn (pictured) and the AIM/Flying Doctor, but to what extent is not clear from the information to hand.

A quick coat of flat black paint on the 'unresisting black cock' put an end to the suspect 'transmissions'!

On another occasion, flashing Morse code signals were espied by a loyal and enthusiastic citizen, emanating from a coastal sanitary depot and presumably intended for passing enemy ships. This time, the offending light source proved to be low-slung hurricane lantern(s) with their light being chopped into dots and dashes by the leg movements of the horse(s) used to transport the 'dunny' cart(s)!

Into the 1920's

Following the war, with the role of radio and technical personnel much better understood, their confiscated radio equipment was re-allocated to the owners and Western Australian amateurs were issued with call-signs prefixed by OA6, standing for Oceania-WA. The now-familiar 'VK6' prefix came much later. The WA Radio Club was reactivated and, on November 3, 1919, re-constituted as the Western Australian Branch of the WIA — Wireless Institute of Australia. (See panel.)

In the immediate postwar years, Wally Coxon's amateur activities moved out of the spark gap/Morse code era to valve-based continuous wave technology, and to speech transmissions suitable for reception by listener/experimenters within the public at large. As much as anything, such transmissions were intended to stir public — and departmental — interest in radio as a potential medium for disseminating information and entertainment.

One such Coxon broadcast was featured at the Perth Royal Show around 1918, with a demonstration transmitter on display in one pavilion and a demonstration receiver in another on the far side of the showground.

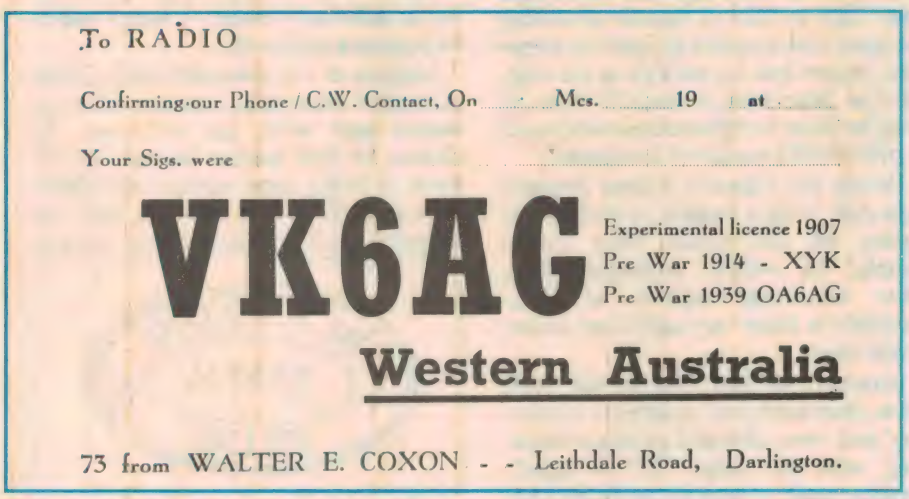
Wally Coxon also claimed to have originated the first-ever music broadcasts in Western Australia, in about 1920. Emanating from his own amateur 'rig' in the family home in Sixth Avenue, Maylands, they featured records borrowed from a Perth record company.

That such transmissions didn't go unnoticed is evidenced by the fact that an entry in the *Macquarie Book of Events* about the contribution of amateur radio 'broadcasters', groups W.E. Coxon 6AG with such well known figures on the east coast as Charles Maclurcan 2CM, Joe Reed 2JR, Jack Davis 2JD and Maxwell Holden 3BQ. A similar reference appears on page 13 of Philip Geeves' book *The Dawn of Australia's Radio Broadcasting*, recently published by *EA*.

First WA broadcaster

Mr Peterson says that Walter Coxon subsequently played a key role in the establishment of Western Australia's first public broadcasting station 6WF, broadcasting on 'long waves' like Sydney's 2FC. (According to the *Macquarie Book of Events*, it went to air on June 4, 1924).

Under Australia's abortive 'sealed set' system, 6WF was to have been supported financially by listeners paying an annual subscription fee of four guineas (£4.4.0, or $8.40). As a projected commercial venture, it was housed on the top floor of the Westralian Farmers building in Wel-


To RADIO

Confirming our Phone / C.W. Contact, On ..... Mcs. ..... 19 ..... at .....

Your Sigs. were .....

VK6AG

Experimental licence 1907
Pre War 1914 - XYK
Pre War 1939 OA6AG

Western Australia

73 from WALTER E. COXON - - Leithdale Road, Darlington.

Fig.4: Printed in red and black, Wally Coxon's QSL card is an historical statement in its own right. His callsign is shown as XYK (pre-war 1914), OA6AG (pre-war 1939) and VK6AG (current).

lington Street, Perth, with two masts on the roof supporting the antenna.

When the sealed set scheme was replaced by the 'A' and 'B' licensing system, 6WF was classified as an A-class station, meaning that it would be supported by a share of listeners' licence revenue collected and allocated by the Federal Government. As such, it passed ultimately into the control of the Australian Broadcasting Company and thence into the present-day ABC.

Wally Coxon recalled that, in those days, broadcasting stations were 'popping up all over the spectrum'. In Australia, they were being established on 'long waves' and 'short waves' — the latter being subsequently re-classified as the present-day 'medium-wave' (AM broadcast) band. Long and short/medium waves were variously favoured for their reputed daytime and/or nighttime coverage, their vulnerability to thunderstorm interference and, by implication, their siting in terms of latitude.

An extreme case, according to Wally Coxon, was a station set up in Bordeaux, France, operating on a wavelength of 23,000 metres, equivalent to 13kHz. Inside what would be classified today as the audio spectrum, its carrier was directly audible, given certain conditions, as a high-pitched whistle.

Like other broadcast stations in its day, 6WF sought to attract public interest by stunts and live coverage of current events.

Striking publicity

On one memorable occasion, Wally Coxon advised 6WF listeners that, if they tuned in at 12 o'clock on a particular day, the Perth Town Hall clock would be heard to strike 24 times instead of the usual 12. And, sure enough, right on cue, the clock went into an apparent ringing frenzy and pealed out 24 o'clock midday!

The explanation was simple enough: the broadcast involved two live microphones, one that had been installed permanently in the Town Hall and another set up on the roof of the Westfarmers building in Wellington Street, about half a mile away. The distance was such that, at the comparatively leisurely speed of sound, the chimes picked up at the studio were neatly interposed between those conveyed by landline from the Town Hall.

On another occasion, 6WF undertook to do a live broadcast of an important rowing event on the Swan river. The problem was that, as often happened in the early 1920's, they encountered great difficulty in obtaining access to the necessary telephone lines. They had to compromise by doing a semi-phantom broadcast, with the assistance of two Navy semaphore signallers. One in King's Park spelt out the vital information with his flags, while his mate atop the Wellington Street building scribbled it down and passed it to the announcer — who, at best, had only a distant view of the proceedings, through binoculars.

Two other public broadcast stations in which Wally Coxon had a hand are no longer in existance, although old-time WA dial-twisters may well remember them. One of the stations, 6BY, operated for two years in Bedford Hall, Bunbury, just opposite the railway station. It was closed due to financial problems during the depression.

The other station, 6ML, was established by Musgraves Ltd, opening officially on March 19, 1930. It was later taken over by WA Broadcasters but closed down during the war years, largely because of the prevailing manpower shortage.

> The WA Division held its regular monthly meeting in the Science Room on Thursday, March 31. The President, Mr Coxon, presided over a large attendance.
>
> It was thought that as restrictions are being lifted by the Dept, and as amateurs are recommencing activities, a reorganisation of the work of this Division should be considered.
>
> Meetings will be held fortnightly instead of monthly, to be held in Warwick House on the second and fourth Wednesday of each month. The mid-monthly meeting will take the form of lectures, demonstrations, etc.
>
> A regulation was gazetted that members erecting wireless aerials must fly a pennant designed and issued by the Institute.
>
> It was further decided to communicate with the Central Body to make representations to the Dept concerning the issue of transmitting licences. Several members stated that amateurs in England and America were granted licences and encouraged in every way to carry out investigations, while in Australia only receiving licences were issued.
>
> ***('Sea, Land & Air', May 1, 1921)***

> The Annual Meeting of the WA Division was held on Wednesday, June 22, Mr W.E. Coxon presiding.
>
> The President, in his retiring address, said that, since the Annual Meeting, the control of Wireless Telegraphy had been handed over by the Dept of the Navy to the Postmaster-General's Dept. The issue of (new) licences to private individuals was still a burning question.
>
> Before the war, both sending and receiving licences were issued. Although the regulations had not been altered, transmitting licences were not now issued except under very special circumstances.
>
> ***('Sea, Land & Air' August 1, 1921)***

The Flying Doctor?

But for one final paragraph, Mr Peterson's account of his 1967 interview with Wally Coxon ends there. I quote from his original letter:

At this point in the sunny morning interview, I asked Mr Coxon: "And what of your association with the Royal Flying Doctor Service?" He replied: "Ah, that's another story again!"

Not to be put off, I reached for my copy of *John Flynn, Apostle to the Inland* by W. Scott McPheat. Guided by the index, I discovered one lone reference to Wally Coxon in chapter 22, entitled 'The Revolution of Radio' (p.204). I quote:

The Wireless sub-committee also worked out a complete system making the best use of the channels available, in short, medium and long-waves. A radio handbook was prepared by W. Coxon of West Australia. Tenders were called for the provision of transceivers, and Traegar won the contract.

By way of context, Flynn had been wrestling with the problems of the inland since at least 1912, central to which was the potential role of wireless communication.

The PMG's Department and large firms like AWA were favourably disposed to the project, but their expertise in remote and mobile communication had to do with shipping and military applications involving trained operators, large host vehicles and professional support resources. In an environment of non-technical bush padres, doctors and nurses, makeshift transport and indifferent back-up, they were at a complete loss.

Flynn had come to realise that the people most likely to devise practical answers were self-motivated hobbyists and amateurs, who were adept at setting up wireless communication with makeshift resources. It was no accident that the wireless committee of the AIM — Australian Inland Mission — should include an amateur-turned-professional like Wally Coxon, and that they should assign the technical responsibility to the near-legendary Alfred Traeger (Traegar?).

As it happens, I have been planning for some time to devote a future episode of 'Think Back' to Flynn of the Inland, but I now find myself in a position of knowing that Wally Coxon had a role in that story, which neither he nor Scott McPheat chose to enlarge upon.

Hopefully some Western Australian reader will be able to come up with further information that will help fill the gap! What role did Wally Coxon fill in relation to the AIM, and for long did he remain active after 1967? It's over to you! ❖

Electronics Australia

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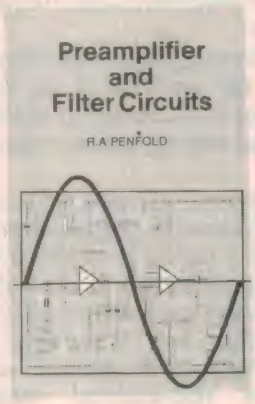

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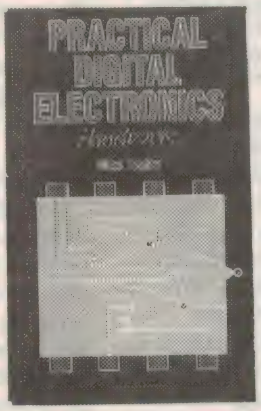

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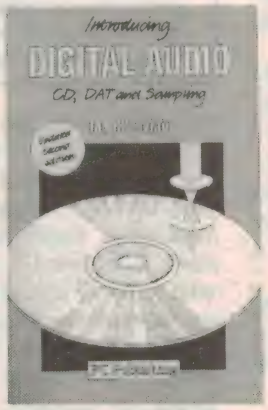

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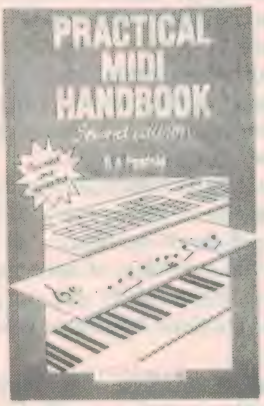

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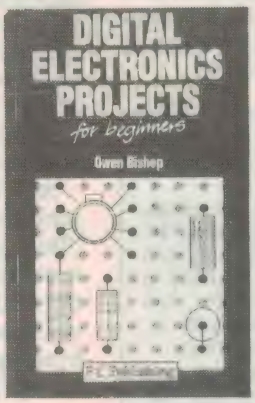

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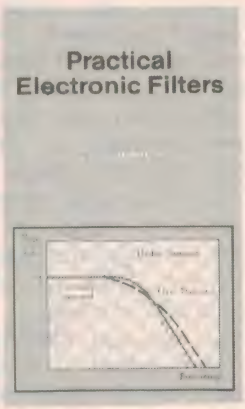

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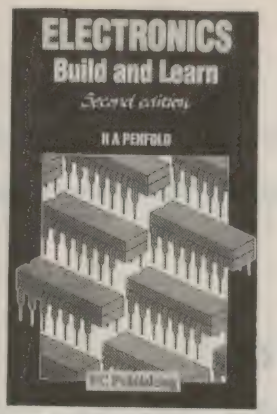

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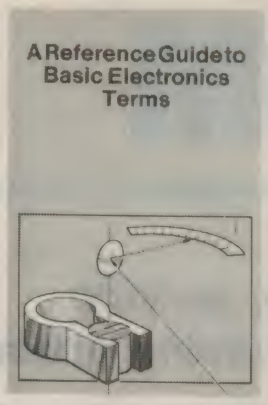

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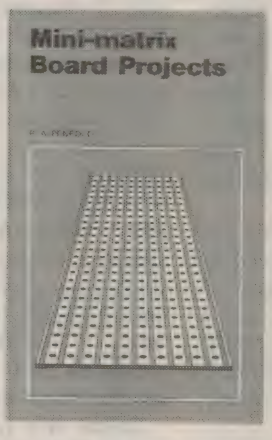

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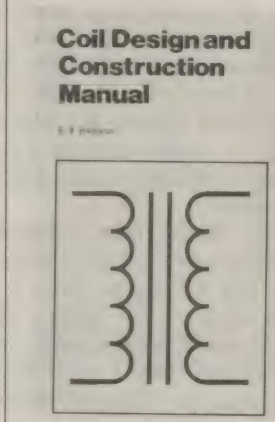

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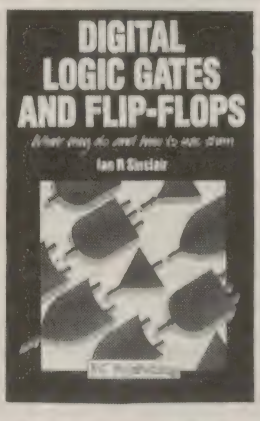

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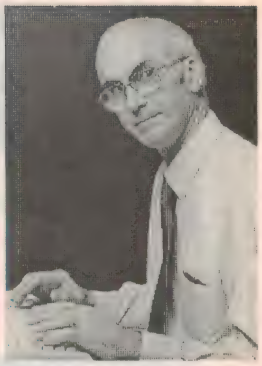
FORUM

Conducted by Jim Rowe



Parts availability, service, standards and 'having oneself on'...

I have quite a mixed bag for you again this month, folks. There are a couple of letters with comments about local parts availability and the kind of run-around you can get from some service organisations, plus some very interesting items I spotted in other publications on the subjects of (a) the need for standards, and (b) the ability of we human beings to fool ourselves when it comes to things like sound reproduction.

There hasn't been much direct response yet to my editorial in the August issue about electronic component availability. Perhaps I was wrong, and few people see this as a problem area. Either that, or there's simply been a lull while everyone is writing their lists of grievances — either against me, if I *was* wrong, or against various parts suppliers if I wasn't!

A few letters more or less directly responding to the editorial *have* arrived to date, and I'll quote from a couple of them shortly. But before doing so, I should note that the situation has actually deteriorated since I wrote that editorial, with regard to the availability of many semiconductor devices.

Even some of the 'garden variety' devices which have been readily available for years, and used in many of our projects, have virtually 'dried up' in the last month or two. But this is not due to any slackness on the part of our local parts distributors and stockists, I hasten to add. Rather, it's due to some different factors altogether.

After talking to some of the local distributors, retailers and kit suppliers, I gather that many of the major semiconductor manufacturers have recently carried out a 'rationalisation' of their product lines, and dropped some of the older and slower moving lines. At the same time many of them apparently took the opportunity to drop the older 'leaded part' versions of some devices, and swing over completely to the more modern surface- mount versions. This is understandable, I guess, because a high proportion of these parts would now be bought by the big manufacturers, most of whom have nowadays swung over to SM technology.

(In the long term, this inexorable move to SMT must inevitably have a major impact on the hobby and educational side of electronics, and on the ability of magazines like *EA* to describe practical projects for manual assembly. But that's another big topic, which I'm sure we'll have to address before long...)

It seems that one of the things which triggered this bout of rationalisation by the semiconductor makers was the well-publicised fire at the Sumitomo chemical factory, in Japan. This has caused a medium-term shortage of the epoxy resin used in making many of the device packages, as Sumitomo's lines apparently produced 60% of the world industry's requirements for this plastic.

Since the fire Sumitomo has announced that the lines are being rebuilt, and should be operational again by the end of the year. So this particular problem shouldn't last for much longer.

But it also appears that another factor behind the rationalisation is a partial lifting of the world recession, at least in some areas of the world and with respect to electronics manufacturing. This has caused a surge in demand for at least some semiconductor devices, and particularly the surface-mount parts. As a result manufacturers have had to ramp up production of these devices, but at the same time many of them are apparently being cautious and not as yet expanding their total production capacity. In short, they're simply re-allocating some of the lines which were making older leaded parts, and swinging them over to make SM parts instead.

You can't blame them, of course. I guess I'd make the same kind of decisions, if I was in their position. All the same, it does mean that the availability of some of the parts we've all taken for granted is going to be rather sticky for quite a while — and in some cases, the parts may have gone forever.

So if you go into your local parts stockist and find a lot of their bins empty, don't assume their buyer is slack. I know I was quite critical of local distributors in the August editorial, but there are now quite a few problems that are NOT of their making.

A lot of component buyer are now frantically trying to source three-terminal regulator chips, 74HC family CMOS devices and all kinds of other 'common' parts, some of which have gone from almost immediate availability to a lead time of a year or more, from the main suppliers. I don't envy them, as they try to find sources of these parts from assorted overseas sources, at prices that their customers will be prepared to pay...

A reader responds

Anyway, enough preamble from me. The first letter I'd like to present to you comes from Mr Will McGhie VK6UU, a radio amateur of Lesmurdie in WA, and it is in fact a direct response to my editorial. I found his letter both interesting and entertaining, and I think you will too. Here's what Mr McGhie has to say:

I read your August 'Editorial Viewpoint' and could not agree more with Jim Rowe's comment on the very average situation with obtaining electronic components in Australia. It has improved compared to some 20 years ago, but finding components is at times frustrating. In general if the item can be found, and if it is in stock, then service is generally good. However there are so many stories that can be told about the poor situation that exists with trying to obtaining electronic components.

One of the best and simplest comes from a young Dick Smith employee. I

asked for 20 BC548 transistors, probably the most common transistor one could ask for. The reply was "We sell so many of these transistors that we are always out of stock". There is no suitable comment to that type of statement, is there?

Another example comes from the same company, when I tried to obtain a highly advertised amateur two-metre mobile antenna. The reply was 'nil stock'. There were plenty in Sydney, but not in Perth. I ordered the antenna and waited. After six weeks, I rang to find out what was the delay. My order could not be found; there was no record of it.

I gave up on the local situation and rang Sydney direct, to ask why they advertise these antennas and yet did not stock them in Perth. The reply: "We don't sell any of those antennas in Perth, so we don't stock them in Perth".

I pointed out to the employee that the reason why their sales of this particular antenna were so poor in Perth was simply because it was not stocked in Perth. It was as if I had given him the secret to life. He agreed that I had come up with the reason for the poor sales figures, and would let marketing know!

Just one more example, this time with Tandy Electronics. I had bought a number of small project circuit boards. Each store only stocked a couple at a time, but as I only wanted a few now and then over several months, there was no problem. However the day came when most of the Tandy stores in Perth had nil stock.

Still there was no hurry, and every time I visited a Tandy store I would ask if the board was in stock. After several months the need was becoming urgent, and I enquired in more detail as to what was causing the delay. The employee checked the computer and found that these items were not being ordered, because as far as the system was concerned there where some 300 in stock in Western Australia. The problem was that few of them were in Perth — they were all in country towns throughout WA. The computer system was not detailed enough to see the problem.

These administrative problems continue to exist because there may not be any interest from the service counter, nor a mechanism to inform more senior staff of the problems. Everyone floats along, quite happy to say "Sorry, that item is temporarily out of stock, but there is a new shipment coming in next week". How many times have you heard THAT line?

These problems are with items that companies advertise and purport to stock. When it comes to components that are not to be found as a stock item, the situation can be very frustrating and time consuming.

I have a solution to all this. In 'the age of the computer', why not establish a growing databank of components and suppliers for use by small time hobbyists? I know some companies have their parts on disk and there are some expensive commercial systems, but to the hobbyist these offer no solution.

What is required is some organisation (like Electronics Australia) to start up a data bank of components. The information could be sought from all electronics suppliers, who could supply the information on disk or via a modem. If the system was smart enough, the supplier could connect to this databank like a phone BBS and download the information. Little effort would be required by whoever operated the system.

There could even be a profit in the system. I know I would be only too pleased to be able to purchase a disk for a small fee, or connect to a component BBS to obtain the location, cost and availability of the components I require. If the software was smart enough, a search facility would make it all so easy.

Find 'BC548', and there are all the suppliers and prices listed.

Sounds too easy, does it not? The system would grow over time. There could even be a user input area for components that had been tracked down.

Everyone could benefit from this. The long searching frustrated hobbyist (and professional by the way who also has the same problem), the databank supplier who might be able to make a profit, and the supplier who at times makes you wonder if they really want to sell the item anyway.

There is my solution to this big problem. Sounds easy to me — now tell me why it won't work!

Thank you for your anecdotes, Mr McGhie — they certainly struck a few chords, and I guess we've all heard that line about a new shipment 'coming in next week'. Not just from places like DSE or Tandy, of course — it's been a fairly standard 'brush-off' line from many suppliers, over the years. A bit like the one about 'your cheque is in the mail', so beloved by accounts payable clerks!

Your suggestion about us starting up an electronic database of components and their suppliers is an interesting one, but there are already a couple of firms providing services of this type. Unfortunately it costs somewhat more than you might expect, setting this sort of thing up and maintaining it properly, and as a result the cost of subscribing tends to be fairly steep. This tends to make it a service affordable only by the larger firms and organisations — so again the hobbyists, small firms and students are left out in the cold.

At the same time, the existence of the firms already providing this kind of service to the big customers tends to mean that if *we* were to try setting up a 'poor man's version', we probably wouldn't be able to cover our costs — let alone make any kind of profit. We also don't have the staff to tackle this sort of project, I'm afraid, so at present it's a bit impracticable. Still, I'll see if we can't set up at least a mini database on one of our computers, so that we can at least keep track of the sources for *some* of the harder to get parts — when we happen to find out who can supply them!

Customer service

Still more or less on the subject of component availability, but also branching out a little into the area of 'customer service', I'd like to give you an excerpt from a letter which came from Mr E.J. Lom, of Northmead in NSW.

A fairly large proportion of Mr Lom's letter was on the subject of 'back EMF', and ways of dealing with it when you're designing solenoid driver stages. This is quite interesting, and I'll try to present it when space allows in the new few months. However Mr Lom also provides the following account of an experience he had when trying to fix a fault in his TV set:

On a closing note, I would like to relate to you my experience last year with one of the major television set manufacturers. I own one of their sets (and it is a very good set, with an excellent tuner and picture), which is fitted with microprocessor based presets and memory. The data is stored in an EEPROM and this had failed, although I did not know this at the time; the fault only became apparent when new data was being stored.

After installation of an updated aerial, I needed to store new information for SBS and of course was unable to do so. The designers had the forethought to include a number of error codes into the display and in the course of attempting to store the new data all I received was the error code.

Undaunted and with a block diagram of the set in my hand, I deduced that I had three choices: the processor, the memory or lack of programming voltage. The processor was socketed, so out it came (with me taking all necessary static procedures and placing the component into a static-free tube) and off I went to the manufacturer's service centre.

I requested the nice young lady to enquire of the technician:
(a) what does error 'E4' mean, and
(b) could they check out the microprocessor.
Five minutes later came the answers:
(a) They did not know what any error codes meant; and
(b) they could not test the microprocessor, and even if they could, it would be pointless as I already ruined it by taking it out of the socket. End of Part 1...

An even nicer young lady at the service counter overheard my conversation with the nice young lady, and offered additional help as soon as she finished with her customer. And help she did. We found the service manuals (brand new, unused) and found the error codes. We found the test points and test voltages. And we found the prices. A new EEPROM had a trade price of around $27 with 30% sales tax — over $57 retail.

I felt certain that the problem lay with the EEPROM, but at those prices was reluctant to experiment. So I went home and tested the test points and indeed the problem was the EEPROM...

Hang on, I thought, why not try the industrial sales department of the television set manufacturer. A new EEPROM? — yes sir, $7.50 plus 20% sales tax. A bit more reasonable don't you think, but unfortunately out of stock and no longer available. A part consigned to redundancy and obsolescence.

What next? Complain to the manager regarding the help from the technician, congratulate him on the good sense of employing the even nicer young lady, and threaten with the PSA.

The response was superb. The new EEPROM arrived in the post a few days later, with the compliments of the manager — waiving all charges — and the problem was fixed.

Now I am in a dilemma. Do I sing the praises of such service, or do I complain even more, regarding the likely treatment of the people who do not know what is involved in the TV repair side and would have probably had to pay $100 plus if they had taken the set to the service centre? I think I will let you judge.

Hmmm — I agree, Mr Lom, it's a bit like the proverbial curate's egg, isn't it? Good news and bad news, things to praise and things to complain about, all mixed together. I guess the bottom line in your story really is that *you* were able to get satisfactory service only by being fairly pushy and virtually forcing the issue. If you hadn't done so, I agree with you that most of the actions worth praising simply wouldn't have happened.

Thanks for the story, though. It's a good example of the way many service organisations need to lift their game, at the day-to-day over the counter level — not just component distributors.

'Lollypop' market

By the way, I heard today that one of the main semiconductor manufacturers makes no secret of the fact that they're not the least interested in what they call the 'lollypop' end of the market — supplying small quantities of components to hobbyists, students, service technicians or small firms working on their own development projects. They're only interested in the BIG customers, capable of ordering 10,000 parts at a time.

What a short-sighted attitude! Anyone who has studied the electronics industry knows that (a) today's students and hobbyists tend to become tomorrow's engineers, and (b) many of the most important innovations which have resulted in growth of the industry and its

markets have come not from big firms, but from little start-ups...

Perhaps it's no coincidence that when firms get so big they start displaying this sort of attitude, they often seem to self-destruct soon afterwards!

Need for standards

Changing the subject again, long-term readers of this column no doubt recall that yours truly has on occasions been a little critical of standards organisations. Sometimes they have seemed to me somewhat isolated from the realities of the real world, and populated by semi-retired engineers and bureaucrats who have umpteen meetings to decide things like that famous edict wherein resistors were to be shown on circuit schematics by a rectangle — despite the fact that the real 'movers and shakers' of the industry were, and still are using the 'zig-zag' symbol.

Anyway, I guess I've been as critical as any of what has often seemed to be the 'ivory tower' aspect of standards organisations. But I noted with considerable interest a letter which was published in the August 1993 issue of *The Australian Standard*, an official publication of Standards Australia. I think you'll find the letter of interest too, because it shows in a matter-of-fact way why standards *are* needed, particularly in areas to do with electrical equipment.

The letter came from a Mr Jim Kleyn, who is apparently with a firm known as Telecom Australia (Saudi) Ltd, working in Riyadh, Saudi Arabia. I presume this firm is part of the international side of our own Telecom, doing contract commissioning work over there.

Here's Mr Kleyn's letter:

I suppose it is not every day that you get a letter from this place. I am prompted to write to you because of what I find here, i.e., everything is non-standard.

It was not until I set foot on foreign soil that I came to realize how valuable an organization such as yours is. There are many examples of the problems non-standardization causes. In a hardware shop in Riyadh yesterday I counted 47 different electrical plugs and adaptors — a bloody nightmare. The chances of buying an appliance and its plug fitting into your socket are almost nil.

In desperation, tradesmen rip the plugs from their electrical tools and stick the wires directly into one of many varying sockets they find in their travels. Even at work with Saudi Telecom the photocopying machine is 'plugbare' and the wires are stickytaped into the 220V — or is it 110V? — socket. Many of us have damaged our stereo/video equipment because of what we thought was a 110V socket turning out to be 220V.

I visited Damman recently to conduct a conference. We were running late. "Is the overhead projector available?" I asked. "No worries Mr Jim, everything is ready." You guessed it — the plug didn't fit the socket and someone went looking for an adaptor. Could not find one anywhere (someone else with a difficulty had swiped it); meeting half an hour late. I could have pulled the plug off and used the wire trick but, being a guest, I hesitated.

Our bathrooms upstairs flood the rooms downstairs because there is no waste outlet on the floor. So it goes on.

If anyone in Australia complains to you about bureaucracy, rules etc., give me their names and addresses; I'll tell them a thing or two.

Keep up the good work!

Jim Kleyn

Telecom Australia (Saudi) Ltd

Riyadh, Saudi Arabia

As you can see from Mr Kleyn's letter, things seem to be rather chaotic in that part of the world when it comes to mains connectors — and even mains voltage. I guess we all need to read a first-hand report of this type from time to time, to reinforce the fact that a fair degree of standardisation is important for things to run smoothly.

Picking the difference

Finally, I think we just have room this month for the summary of an item I spotted in a recent issue of *New Scientist*, that excellent publication based in the UK (but now available in an Australian edition). It concerns tests carried out in Germany recently, which seem to shed some light on an area we've discussed quite a bit in this column of late: the ability for we humans to fool ourselves, when it comes to comparisons of hifi equipment performance, the effects of fancy cables, etc.

In the item, Claus-Peter Sesin reports that Klaus-Ernst Behne and Johannes Barkowsky, two 'music psychologists' from the Hannover Conservatory, carried out tests where they played identical jazz and classical music recordings on CD's and vinyl records alternately, to some 160 audiophiles. The tests were carefully controlled, and the subjects were asked to decide (a) which medium was being used each time, and (b) to describe the differences in the sound. In one group of tests a very high quality CD player and turntable were used (around £4000 each), while in the other group a pair of 'medium quality' (around £400) units were used.

The subjects consisted of music lovers who frequently attend concerts, professional musicians, audio component designers, sales staff from hifi stores, and people with 'no special interest in music'. Each person heard a single sequence of six alternating items, to minimise fatigue.

It turns out that only four subjects out of the 160 were able to distinguish between the CD and vinyl versions every time, and only 17 more scored five out of six correct. Apparently the music 'buffs' scored no higher than casual listeners, and there were no differences between the tests using expensive gear and those using medium-priced gear.

Although there was a *slight* trend confirming that overall, the listeners found the CD sound more 'brilliant' and the vinyl sound more 'warm', 23% of the listeners actually found the CD sound 'warmer' than the vinyl. Similarly another 22% found the vinyl sound 'more brilliant' than the CD!

Even more of interest were the results of a further test, where the researchers played the music solely from the CD player, but changed its volume to suggest the same kind of source changes as before. A high proportion of listeners again heard differences, even though there were now none!

The German researchers concluded that the listeners were influenced by their prior experience, and basically heard what they expected to hear. Interesting, don't you think? ❖

THE SERVICEMAN

An IC that somehow killed other parts, and another that kept on 'ejecting' from the PCB!

I have a *really* mixed bag for you this time. There's the story of a new serviceman who faced a near-impossible first house call, another from a seasoned expert with an IC fault he simply couldn't explain (and nor can I), a fascinating tale of a VCR which kept ejecting one of its ICs instead of the cassette, and some more clarification about the somewhat confusing labelling used on some of NEC's horizontal output transformers.

I'm going to open the account with a short tale of woe from a relative newcomer to the industry. He is Mr P.W., of Raymond Island in Victoria. As you will see, P.W. is one of those folk attracted to the service industry as much by the economic conditions as by interest in the trade. However he has a droll sense of humour, which should stand him in good stead as he works his way through life.

And if he passes on more stories like this one, we'll each feel a little happier with our own lot. He calls his story: 'NEW ~~KID~~ NECK ON THE BLOCK'.

Why did I do this? I didn't have any urgent desire to be a TV technician, but on the other hand being broke wasn't one of my more desperate desires, either. So I enrolled in a correspondence course in TV and video repair.

My first house call was a nightmare. I'm a timid soul and dislike meeting strangers. Nor do I like going into their homes. My scrupulous politeness often costs more than I think it's worth, but — my first house call.

A 'phone call after only a few days of advertising seemed like good luck, but from the symptoms I knew that it was an antenna problem and I had no wish to go climbing about on a roof. I suggested that the lady get hold of the local antenna specialist. But no! It had to be me, even though she already suspected it was the antenna.

I arrived at the customer's home looking as smart as it's possible for me to look, and holding an enormous fishing box (read tool box) in one hand and my DMM and clipboard in the other. A man arrived at the other side of the screen door so I said, "Good Morning! Mr Smith?" He agreed with me on both counts.

I prompted him. "You've got something wrong with your television?" He agreed again. We stared at each other through the screen door. After a few moments he said, "I suppose you'd better come in, then". He didn't sound very certain, and half way to the TV he spoke again: "Did my wife 'phone you?"

"Yes, last night." He nodded and then explained that he'd been out prawning all night, so wasn't expecting me. Well, that cleared up his surprise at seeing me.

I had checked on my way in that the antenna didn't have a booster or splitter of any kind, so I checked the resistance across the conductors of the antenna lead-in. ('Test number one for antennas' said the lesson in my course notes!).

Sure enough, it was open: either a broken lead-in, or a broken or dirty antenna connection. Tough! The antenna was up a thirty-foot pole. I wasn't going up there, and neither was Mr Smith.

I was reluctant to ask Mr Smith for my call-out charge just for telling him in person to ring the antenna specialist (or to find a friend who didn't mind heights). But I had to do something to justify my presence. So, just for the practice, I took the back off his set, "...checking the connection from the antenna socket to the tuner".

I told him my service fee was $35 but that I'd only charge him $10, since there was nothing I could do for him. That was fine by Mr Smith, but he didn't have any money in the house anyway!

Damn! Damn! Damn! My first house call. Nothing wrong with the set. And I didn't even collect my cut rate fee!

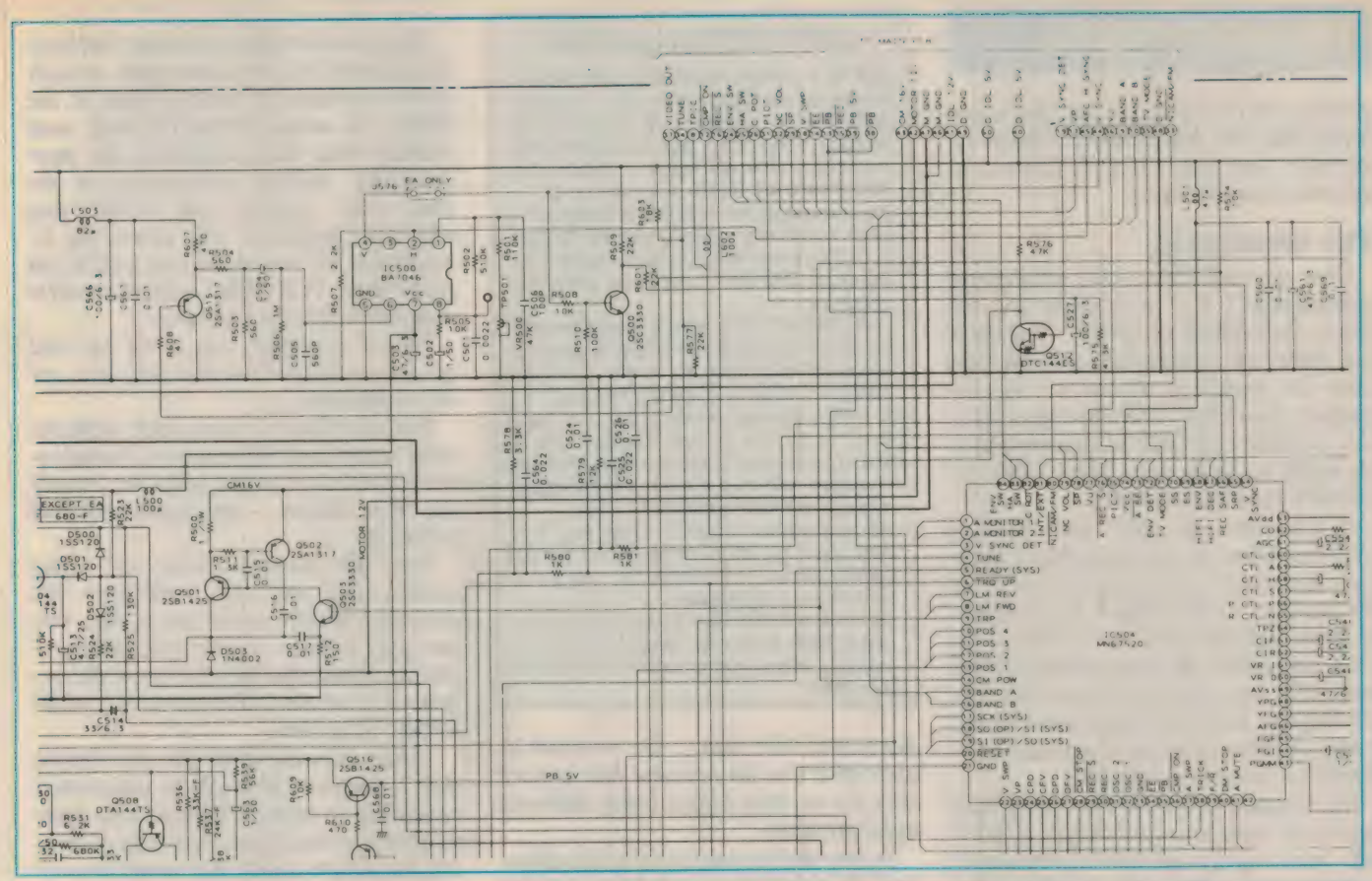
You poor sod, P.W.! I know just how you felt. But we all had to do our first house calls once, and there was that nagging doubt that the customer would learn just how inexperienced we were.

Still, it's remarkable just how quickly you get used to working in the customer's home. The secret is to have an enormous tool box, filled with all manner of bits and pieces which you can spread all around you. It looks impressive and takes the customer's mind off things like the final bill. (Sorry — just kidding!)

Anyway, P.W., you might have missed getting paid by your first customer, but your fee for telling us the story will ensure that the job does not go entirely unrewarded. Thanks a lot.

Killer chip?

Now we get back onto more familiar ground with a story from P.S., of Thornlie in WA. P.S. tells us about a thoroughly confusing problem with a near-new VCR. In fact, it's so confusing that I'm still not sure exactly what the trouble was. See what *you* think...



A section of the circuit for an Akai VS-F510 video recorder, which forms the subject of the story from P.S. What seemed to be a simple fault in the vicinity of sync separator chip IC500 turned out to be somewhat more complicated...

My father and I operate a 'video only' repair business, so we are often called on to solve 'tricky' faults for non-specialist technicians. Even so, every now and then a fault comes along that seems to defy logic (and physics), such as the recent case of an almost new Akai VS-F510. It played back tapes perfectly, but the recordings it made had a head-switching bar drifting through the picture.

My first thought was that the head drum servo was not phase locked in record mode, and this was quickly confirmed by observing the strobing effect of the rotating head drum under a 50Hz light. It should appear stationary, but was moving in this case. Now in the record mode, the drum servo is phase locked by comparing PG, the pulses generated in the drum motor, with vertical sync pulses derived from the off-air signal — in this case inside IC504, an 84-pin surface mount chip. Changing these chips is not a nice job, so you need to be very sure of your diagnosis before attempting this!

A check with the CRO on pin 48 showed PG was present, but on pin 64 there was no vertical sync — which IC500, a sync separator, derives from composite video on pin 6. There was no video to be seen on this pin, however, so a check on the transistor feeding it, Q515, showed there was video on the base. So it was out with the ohm-meter. The transistor tested short-circuit and L503 in the emitter line to the 5V rail tested O/C.

Easy — replace these and the fault is fixed! But of course it wasn't! Same symptoms, in fact. However, I now had video going into pin 6 of IC500 and vertical sync pulses coming out of pin 4. But they didn't make it to the servo chip, and the only thing in between was Q500, used to invert the pulses.

The sync pulses could be seen on the chip side of base series resistor R508, but there was no sign of them on the base side. I checked the transistor and all the components around it and even replaced the transistor, all to no avail. So I desoldered the base of the transistor — and now I had almost the same amplitude pulses on both sides of R508!

I fed a square wave into the base of Q500 and could see an inverted version coming out of the collector — so why did the transistor shunt the sync pulses such that none could be seen on the base?

A phone call to Akai's local service co-ordinator followed, and he was able to check another working machine for me, and could see sync pulses of exactly the same polarity, amplitude and frequency as the faulty machine. I was confused!

While looking again at the circuit, I noticed a trimpot VR500 and test point near IC500, so while waiting for inspiration, I looked in the manual to see what these were for. The trimpot is labelled 'AFC ERROR', so I put the CRO onto test point 501 — and found that the waveform bore no resemblence whatsoever to that shown in the manual!

Now this must surely indicate there is some problem with IC500, I reasoned, so a new chip was ordered. A week or so later, the chip arrived. I fitted it and the fault was fixed. But why? The waveform on test point 501 was now correct, I had exactly the same sync pulses on pin 4 but now they were inverted correctly by Q500 and fed to the servo chip. Was there some change in the output impedance of the chip, or some high frequency present that I could not see on the CRO?

Luckily, we don't have to answer these questions to get paid for the job, so that is where I stopped puzzling and moved onto the next job — oh yes, I must tell you about THAT one some day, too!

Well, P.S., did IC500 kill the transistor? Or did the dying transistor injure the IC? As I said earlier, I can follow the story but not the logic. In a sense, I'm

glad it was you and not me that came across that one. But thanks for the story, anyway. And yes, I'll look forward to your next contribution.

The missing IC

Now, we turn again to the prolific and entertaining L.K., of Daintree in far North Queensland or 'FNQ'. This time L.K. tells not a yarn of his own, but one from the workshop of one of his colleagues. As we have come to expect from L.K., his tale ends with an amusing twist. He heads his story thus: THIS TIME IT DIDN'T HAPPEN TO ME!

It was the last New Year holiday weekend, when an interstate friend (also a serviceman) "...just happened to be in the vicinity..." and called in for a couple of days. One evening, over a cool, convivial lemonade, the conversation drifted inevitably into servicing in general, (including the dearth of newcomers in the trade) and then to the more unusual, cantankerous faults in particular.

We swapped headaches for some time before he came up with a teaser which I felt was worthy of the 'Serviceman' column, and I have his permission to describe it for your readers. The saga began when a new customer entered his shop carrying a Samsung VCR with a tape stuck in its mouth. Or, to put it more technically, it would not eject.

On inspection, the tape was seen to be in the initial stages of ejection when it and the VCR had refused to go on with the job. As there appeared to be no mechanical hindrance to the operation, my colleague turned to the electrics for an answer. He soon discovered that there was no voltage being applied to the cassette loading motor.

Not being familiar with this particular brand, and without the aid of the circuit diagram, he traced the motor leads to the main board where they finally terminated at an IC — except that the IC was not there! Believing that his eyesight must be failing rather more rapidly than his body, he repeated the exercise several times, but always finished up at the same point. As he said to me, "The leads just couldn't go nowhere. The thing would NEVER have worked!"

The next idea was that it may have been handled by some other organisation prior to being brought to his workshop and that the repair was not completed before the owner, for reasons unknown, decided to take it elsewhere. But alas, a phone call to the said owner, diplomatically explaining the impasse, promptly discounted this theory. He received an assurance that the machine had stopped only the evening before being delivered to his premises.

So how did he make sense of the dilemma? He didn't! He decided there was no alternative but to order the appropriate component from the agents, and proceeded to pack the machine away until the part arrived. By now showing signs of frustration, he apparently picked the machine up rather roughly and heard a noise that suggested that something was sliding around inside. Further investigation unearthed the elusive IC, lying on the bottom cover-plate!

"Could it have just fallen out?" he queried. In spite of warning bells in the subconscious, a close inspection of both the board and chip seemed to suggest that the soldering process had somehow all but missed this small section of the PCB.

He was aware that the owner had very recently arrived from interstate, so with all the rashness of making facts fit the theory, he assumed that the long road journey must have weakened the poor soldering, causing overheating at the pins. And because the board was mounted component side down, the IC eventually fell out. In any case, refitting it restored the VCR to full operation and it was returned to the customer.

That, I expected, was to be the end of my colleague's tale. But not so! He continued...

Two days later it came back, with the same complaint. Even worse, investigation revealed it to have failed for exactly the same reason — the same chip had fallen out!

Now he doesn't boast of many talents, but will bet money on his soldering ability. As he put it, this was not only a blow to the ego, but completely demolished his theory on the sequence of events which led to the initial failure. To quote:

"After allowing time for the known data to meander through the old cranial computer, it seemed logical that there must be overheating to the extent of melting the solder joints. But could a solid state device do this without self-destructing?" Given today's technology, we decided the answer must be yes.

The next step in the repair was to decide just how it could manage to reach that temperature. With no obvious shorts in the system, the loading motor itself was eyed with increasing suspicion. Lacking any information on its power consumption, he compared the Samsung motor with one of similar appearance from another brand of VCR. The Samsung was drawing more than twice the current of its competitor, yet calculations suggested that notwithstanding all this, it was still insufficient power to heat the IC to 'solder-melting point' in the time of a single loading or unloading cycle.

In fact, he found that it took at least 10 continuous load-eject cycles, to achieve a molten state! But how could this come about in a domestic situation?

Obviously a new motor was indicated but prior to placing the order, my friend again phoned the owner to explain the position, this time in considerable detail, and also to make discreet enquiries as to the age of his children. And with THAT question he finally hit the bull's eye!

The customer was the proud parent of one offspring ('Dennis', I think he said the name was), too young to appreciate the marvels of TV sitcoms yet sufficiently developed to entertain himself for long periods by the visually repetitive antics of

JUST FOR A LAUGH

Cliff is a country technician who lives a couple of hundred yards uphill from the Municipal tip. He spent all of one recent weekend clearing out his shed and workshop. Then on Sunday afternoon he took a vanload of junk down to the tip.

He was out on the road all next day, so it wasn't until that evening that he looked over the new work his wife had taken into the shop. One item in particular gave him apoplexy.

"What's that @*!%# thing doing here?" he raved. It was a particularly large and heavy 26" television, the very one he had carted to the tip only the day before.

It seems that an elderly gentleman had found it on the tip and decided that it would go well in his loungeroom. He had struggled with it up the hill, into the shop and asked if Cliff would fix it for him.

He was rather hopeful, since the 'TV' consisted only of the cabinet and a dud picture tube — the chassis had long since been cannibalised.

To make a bad matter worse, Cliff had to cart it back to the tip himself, since the old chap wasn't interested once he heard the story!

Fault of the Month

General Electric CTV model GE342

SYMPTOM: No colour at switch-on, or after changing channels. Colour can take anything from 30 seconds to five minutes to appear.

CURE: Re-adjust the colour subcarrier oscillator. The correct phase and frequency of this oscillator is essential for correct decoding of colour, and in this case the AFC circuit was having a hard job pulling the oscillator into line.

This information is supplied by courtesy of the Tasmanian Branch of The Electronics Technicians' Institute of Australia (TETIA). Contributions should be sent to J. Lawler, 16 Adina Street, Geilston Bay, Tasmania 7015.

a VCR loading and unloading a cassette. This fascination had been put to full use by his wife, as a diversion while she prepared the evening meal.

Apparently it all turned out happily. But if people like this would be a little less secretive, it could save time, frustration and of course money for both them and the PBS.

You know, L.K., I sometimes wonder if your stories are not just the workings of a brilliant but overactive imagination. They *couldn't* be true, could they? And yet they are told with a perfectly straight face, so they MUST be true!

If the things you describe happened to ordinary servicemen, things like ICs unsoldering themselves, then we would all be round the twist. But you tell these stories, and survive, and come back with more. So long may L.K. reign over the Daintree!

(By the way, if you're puzzled about 'PBS', I'll explain this later.)

All trannies ain't...

Now it's my turn to say a few words.

In the July column I wrote about a 'Nasty NEC', a TV job which I was unable to finish off properly, nor could I explain exactly what was wrong with the set. Since then I've had some feedback which does help a bit in explaining what went wrong with that job.

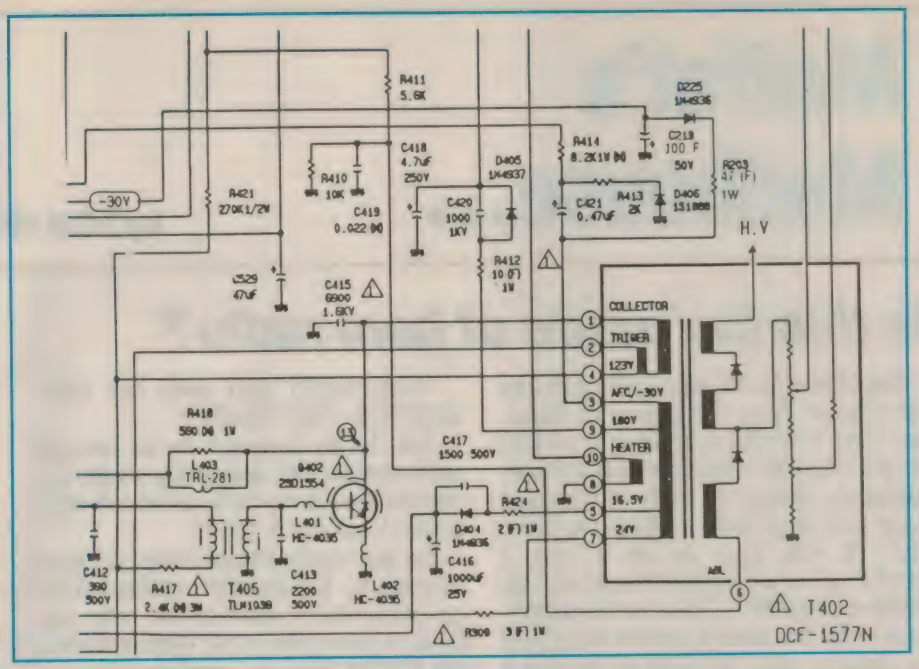
It would appear that the line output transformer referred to in my story was perhaps not as identical as its part number might have indicated.

The original transformer that I had removed from the set carried a sticker proclaiming its part number to be DCF-1577. A number similar to this was shown on the circuit diagram in the service manual, but was not shown in the parts list in the same manual. In that case two numbers were given, 79TD1076 and 50H0000089, neither of which relate in any way that I can see to DCF-1577!

As well as the DCF part number, the sticker on the transformer also carried a batch number M9D29?, and the manufacturer's name, Daewoo. I show a query in the batch number since it appears that the batch suffix is an important component of the part number, even though it's not mentioned in the service manual.

The transformer that I tried to use as a replacement carries the suffix 'A' — i.e., 'DCF-1577 M9D29 A'. Unfortunately, the set that inspired this story is no longer available to me, but I suspect that its transformer was a DCF-1577 M9D29 'N'. And I'm told that there is also a DCF-1577 M9D29 'S', used in something else, somewhere.

It seems that the manufacturer has produced a chassis that calls for three varieties of the same line output transformer. Or perhaps more correctly, they have produced three different transformers and given them the same part number — then added a suffix so that they could be told apart!



The horizontal output stage of an NEC model N-3410 CTV, showing the identification for the HOT. Note the 'N" at the end of the (shortened) type number.

When I wrote the original July story, I was apprehensive about condemning NEC since there may have been some fault on my part. However, in the light of the information I have since come across, it seems that NEC have been really remiss in not publishing an accurate service manual. If the different transformers were known when the manual was printed, why were the correct numbers not advised then? Or, if this information has only become known lately, why was I not told about it when I had a long phone conversation with the company's service department?

All things considered, this matter has been a most unfortunate adventure. It's done nothing to advance the reputation of NEC, and it's left me with a reputation for incompetence, at least with one customer. And in all conscience, it's probably not NEC's fault anyway. The sets were made in Korea (possibly by Daewoo) and were only badged as NECs. But that doesn't help the customer, the serviceman, the retailer, the distributor, or the nominal manufacturer.

Since writing the foregoing paragraphs, I've learned a little more about the problem again. It seems that the 'A' series transformers, the DCF-1577 M9D29 A units, are used in a Tempest chassis, model TE-14RC. The 'S' type transformer appears in an AWA model, the C3425 with the C-43M chassis if I am not mistaken.

I've also taken a closer look at the NEC problem and find that the solution may have been staring at me all the time. On the N3410 circuit diagram, the line output transformer part number is given as DCF-1577N — albeit with no reference to the M9D29 part of the series. I missed the subtlety of this number since I was confused by the totally different number given in the parts list, and by the fact that parts suppliers listed a DCF-1577 transformer without any suffix.

Now that we are alerted we won't fall into the trap again. Just the same, I'd like to be able to recover the sets that have been junked because of the (then) insoluble problem.

That's all for this month, but we'll be back in 30 days, health and weather permitting. (Oh, yes. If you hadn't already guessed, PBS — pronounced 'peebs' — stands for 'Poor Bloody Serviceman'!) ❖

Moffat's Madhouse...

by TOM MOFFAT

Is this the future of ham radio?

One of my favorite ham radio activities has always been fiddling with antennas. One weekend I decided to rebuild the big wire antenna at our beach shack, taking the droop out of it and pruning away any trees that touched the wire. Then it was time to try it out. I tuned it up on a couple of bands with no problems, and then I came to 20 metres. As is often the case, a *contest* was going on. Stations were crawling all over each other trying to contact as many other stations as possible.

Tuning along the band, I came to an area that was overlaid with a 'Brrrkk-brrrkk' noise. This was the familiar sound of an overloaded transmitter operating on a nearby frequency. It was making life difficult for hams trying to reach distant stations, and as I tuned along, the noise got stronger. Soon I found its source: a very powerful New South Wales station with a rough, raucous sound. Behind the microphone was a strident voice:

"CONTEST! CONTEST! CALL-SIGNS ONLY! CONTEST!"

When the yelling paused, a distant voice came back on the channel: "You have a very distorted signal." The voice was either not heard, or ignored.

"CONTEST! CONTEST! CALL-SIGNS ONLY!"

Soon another voice chipped in... "Your signal is very distorted." Again, the VK2 operator didn't hear.

"CALL-SIGNS ONLY! CONTEST!"

Well, he had a giant signal here in Tasmania, so he would have to hear me. But I wasn't going to give him my call-sign first up, for fear he'd simply log me as a valid contact for his contest entry and then toss me aside. So I pressed my transmit button and said, "Your signal is distorted". He couldn't ignore it this time.

"YOU PIRATE! GET OFF MY FREQUENCY!"

I tried again: "This is VK7TM and I am the third station here trying to tell you that your signal is very distorted."

What came back sounded like a 'harrumph' or a snort of rage. And then:

"BULLSHIT! GET OFF MY FREQUENCY, YOU PIRATE!"

Aah, lovely language for an amateur radio station. And despite my careful announcement of my own station call-sign, to him I was still a 'pirate'.

But this unpleasant exchange did have its purpose. The distorted station left the air immediately, allowing the other stations to participate in the contest without the splatter from an overdriven big gun operating on 'his own private frequency'.

'Unpleasant' — this is a new feature that has crept into amateur radio in the past few years. I'm sorry to drop the heavy language on you in a family magazine, but I think it is necessary this time to illustrate just what you may find during a casual tune of the ham bands. Normally I try to make Moffat's Madhouse a light column, and I inject a bit of humour when I can. But this month we've got to get serious.

This column follows a discussion between Editor Jim Rowe and myself about how a simple excursion onto the ham bands often results in pain. Jim himself has an amateur licence, but you don't hear him on air nowadays because just about every encounter in the past was a bad experience.

Lots of other people tell me the same thing. So I'm going to air the problem this month (and probably make some new enemies), and then Jim Rowe is going to throw open the Forum column so we can all discuss what's happening and maybe come up with some solutions.

'Freeze 'em out...'

I would hate to be a newcomer nowadays. How many times have you heard a young Novice or Z-call amateur come up on the bands with a tentative 'CQ', only to be met with dead silence? It must be pretty disheartening. We all KNOW people are listening, because they respond when one of their 'mates' calls. But often the newcomer is firmly ostracized; frozen out. Why?

I suspect a lot of this can be traced back to the day when the amateur service lost the 27MHz band to the Citizens' Radio service. Some CB'ers had long been operating on the band as pirates, using equipment thoughtfully imported by electronic retailers. And the pirates were eventually rewarded for their efforts by having the 27MHz band stripped from the amateur service and handed over to them.

Amateurs were not pleased, and CB'ers became universally hated. After all, hams had worked damn hard for their licences, and suddenly their precious 27MHz had been officially handed over to the pirates who had laid claim to it. I have heard stories of outraged hams who vandalised antennas owned by CB'ers, and there have even been death threats.

The next affront was the introduction of the Novice licence. Here was an easy path for CB operators to make their way into amateur radio. The former 'hated enemy' was now part of the club. But the novices had their section of the bands, the old-timers had theirs, and seldom did they mix.

Later it got worse. Novices were given privileges on a portion of two metres. In Hobart, at least, the old-timers immediately established a new net frequency in the part of two metres where novices weren't allowed. They would never be bothered by a young novice wanting to join in on the conversation!

Several years on, the distinction between the classes has blurred, and it is now fashionable for anyone to ignore, or get stuck into, anyone else.

I sometimes come up on 40 or 80 metres, to be greeted by some guy who's obviously been lying in wait: "Are you the VK7TM who writes for magazines? Well I've been *wanting* to talk to you..." And then off we go, with a heap of abuse for my 'inaccuracy' or 'poor attitude' or whatever.

The latest battleground is packet radio. Here you can 'post' just about any message you want, and then head for the bushes before your victim reads what you have written.

It is like graffiti; you do it and then disappear. Your callsign is left behind, but at least you don't have to be there

personally to take the consequences of your actions. I marvel at some of the things I read on packet.

Mention the use of Morse code, for instance, and you immediately get this 'us versus them' thing all over again: "I had to study damn hard to learn the code, and now they're going to hand out licences with no code at all. Damn CB'ers!"

Another trick is the packet virus, a message that contains code to re-format your hard disk.

Selling sinful

Even the concept of 'amateur' is under attack. If you listen to the WIA broadcasts you hear gear being bought and sold; many times the same seller appears week after week, with more equipment. Is the 'seller' really a 'dealer'? Yet to OPENLY profit from amateur radio is considered a sin.

My own entry into packet radio came via the Pocket Packet project, which was published in *Electronics Australia*. I sell the kits for this, and I thus profit from amateur radio. According to messages I read on packet, I should be ashamed of myself. Yet the big Japanese radio companies profit from amateur radio every day, and they are accepted. Is it because they aren't competing with local operations?

When the Pocket Packet kit hit the market, complete with a shareware copy of the excellent Baycom software, the response was immediate: a letter from Baycom advising of their 'Australian Distributor'. They demanded that shareware distribution with Pocket Packet immediately cease and desist. It did. They also said they intended to advise other shareware software sources to 'stop us' as well. The others didn't; perhaps because nobody local was feeling the competition.

The month the Pocket Packet article appeared, this item was circulated on the packet radio network:

This month's issue of Electronics Australia contains an article about packet... written by Tom (VK7TM). I am not proposing to be controversial, BUT there is another way into packet radio through Baycom.

Tom's modem board contains a 7910 chip... and requires a separate power supply. This chip works very well... but for VHF use another (simpler) solution is available. The TCM3105 chip can serve as the modem... and this method has several advantages over the 7910 solution.

1. *The TCM 3105 chip is cheaper...*
2. *The PCB... will fit snugly into a zippy box...*
3. *The TCM3105 modem chip is powered by the computer!*

GIVE IT A GO... BAYCOM IS THE WAY TO GO PACKET!

As far as I know, this was the first attempt to get rid of my 'pesky' Pocket Packet project, and thus allow the purveyors of Baycom to sell their own modems without competition. But whoever wrote that little piece obviously had not bothered to READ my article, because (1) the Pocket Packet kit *does* use the TCM3105 chip; (2) the kit *does* fit snugly into a zippy box; and (3) the kit *is* powered by the computer.

As for that last line 'GIVE IT A GO... BAYCOM IS THE WAY TO GO PACKET!' — is that a commercial slogan, or is it just my imagination? And did it really come from an 'amateur' radio network?

Well, the Pocket Packet kit just refused to go away, and a few months later another item appeared on the packet network, under the heading 'Baycom News':

Let me first comment on a few things which should have made their way to most users around NZ and VK. Firstly, there seem to be a number of people out there offering so-called BayCom modems. Usually you will get a disk with software together with the modems/kit-sets these people offer.

In many cases, this is a trade-off. I'm aware of a number of constructions that have been made to run under BayCom terminal software. Some of them have trouble with the interface levels, others need an external power supply and all have in common that they are not supported by the BayCom team in Germany.

Oh Dear! On the first attempt, they tried to adorn the non-Baycom modem with an alleged obsolete design. That didn't kill it, so now they are claiming that modems not produced by Baycom don't work. Well, several hundred new packet users will attest that they DO work — in many ways better, and at *half the price*.

Then came the next scare tactic:

There seem to be a number of modems that circulate down South where unused HC04 gates are floating freely. This is prone to cause trouble and defective components.

Now any circuit designer worth his salt knows you don't leave unused gates floating. You tie them down to the positive rail or ground.

On the Pocket Packet modem this is done on pin 9 of the 74HC04. It's a little thing really, and the biggest hazard is from the gate going into oscillation and noising up the rest of the circuit. But component failure? Golly!

Anyhow, if you're concerned, take note of *this* message gathered from the 'non-commercial' packet radio network:

Users of genuine BayCom modems obtained through the official distributors in Australia and New Zealand should have no cause for worry.

Now here's the crunch: Had *I* come onto the packet network and tooted the horn about MY kits, I could have easily been hit with a charge of 'using the amateur service for commercial gain'. Yet Baycom is being promoted, by an allegedly 'non-profit' organization, which seems to be able to run quite blatant advertisements with impunity. Not only that, but they can mercilessly rubbish the opposition and nobody can stop them!

And now the grand finale: the July 1993 issue of the New Zealand *Break-In* magazine, the official NZART journal, carried an article on a device clearly labelled a 'BayCom Packet Modem'. Kits were available (price on application) from the official BayCom distributors, in this case the Auckland VHF group. And in the bibliography, there's an interesting technical reference: *Electronics Australia, January 1993... The Pocket Packet Modem by Tom Moffat VK7TM.*

I hereby rest my case.

How long must this go on? There are

MOFFAT'S MADHOUSE

quite a few of us in Australia operating small businesses manufacturing items for the amateur and hobbyist market. Some of these products are very, very good indeed, yet certain people in Australia and New Zealand take great pleasure in rubbishing them. But these products are not so inferior as to discourage others from borrowing from their designs!

Several years ago I was asked (not by *EA*) to review a piece of equipment made by a small Australian manufacturer. This device was being sold in direct competition with others being imported from Taiwan.

I was given a specific instruction about reviewing the Australian product: "Make sure you tip a bucket on it". Here was a local manufacturer making and selling a nice product, but he was 'sinning' by profiting from amateur radio. Or was he just making life difficult for the big importers?

Many times it's people, as well as products, that get rubbished. I remember the time when the operator of a packet bulletin board in Tasmania fell foul of official favour. Messages flew around on the other BBS's, and the poor fellow was pilloried from one end of the state to the other. Then his supporters came in behind him, and yet another war of ham radio politics was under way.

Lest I put you all off ham radio forever, let me point out that the things I am taking about are indulged in by only a small minority.

There are some aspects of the ham scene, and the packet scene, that make all the strife seem worthwhile. Here I quote a packet bulletin obviously produced with some difficulty by an Italian amateur, IT9EFW:

Dear friends, we know how is the situation in Bosnia and in Serbia, and everibody would to like to help them.

Today morning i had received a letter from a dear Radio-friend, his call is: YU4ZS. His name is ZLATIBOR and i had this last diagnosis of his conditions: COMPRESSIO MEDULLAE SPINALIS, REG TH 8-10. LAMINACTOMIA REG EIUSDEM ET EXTIRPATIO TUMORIS INTRADURALIS. EXTRAMEDULLARIS PARAPARESIS INFERIOR SPASTICA.

Last two years, when i had my first contact with him, he was just in bad conditions, and now, without medicines and help i can't immagine how is him! Zlatibor, require to receive only one kind of medicine, because his phisical conditions don't permitted to him others assimilations of medicines. The name of this medicines is BREXIN and can help him to don't suffer to much.

In his conditions only two things can help to survive: the prayers and the Uman high love for the undefended people. He belive in us and i am contacting the Red Cross International for to send Him all of the necessaires and his address is Zlatibor, Stari Urvan, 26340 Bela Crkva Yugoslavia.

I must admit that one got to me. I thought about it a lot; I lost sleep over it. Over here we use our amateur radio privileges to sling insults at each other. On the other side of the world, Zlatibor is horribly sick as he faces the carnage that rips his country apart. And his ham radio mate in Italy calls out in his makeshift English (a lot better than my Italian), "Please help my friend..." A bit of a contrast, don't you think?

All right, FORUM is now open. If you've got any thoughts about what's going on, and any suggestions to improve things, write to the magazine. As you know the Forum column is not shy when it comes to printing readers' views. If you want to get stuck into me — or Jim — go for it.

We have raised a delicate subject, hopefully before it's too late. If we hams don't get our act together, we may find the amateur service a thing of the past. ❖

NOTES & ERRATA

12-CHANNEL UHF REMOTE CONTROL (March 1993):

Some units have displayed poor range, could not be tuned to near the peak power setting, and have been erratic in operation. The cure for these problems is to replace D23, D24, D25 and D26 in the transmitter with Schottky-type diodes, such as the SR103.

Note also that on some transmitter boards, the track which should link the anodes of diodes D3 and D4 is missing. As a result, channel 3 does not work. The cure is to solder a small wire link between the anode pads for these diodes, under the PCB.

Note that as described, and with the above modifications, the range of the system is typically greater than 200 metres. It is possible to approximately double this range by changing resistor R7 in the transmitter from 1k to 2.2k, and increasing the supply voltage to 15V (maximum). If two 9V batteries are used as a power source, connected in series, the resulting 18V can be reduced to 15V by connecting a 3.3V zener diode in series (positive band to the +18V). Little or no retuning is required for this increase in supply voltage, but if the LED is used as the tuning indicator, change R8 to 56 ohms.

PC-CONTROLLED EPROM PROGRAMMER (September/October 1993):

A faster version of the software for this project is now available from the author. The new software is written in 'C', and provides a virtually unlimited capability to alter write operation timing, protocols and logic settings. The new software requires only 75KB of memory during execution and provides a timing accuracy for write operation pulses of 30us or better, on a 33MHz 80386. Both an executable file and a source code listing will be provided on disk for a cost of $10 to cover costs, packing and postage, etc. (A$15 for overseas orders.) Send your orders to Glenn Pure, 6 Cutbush Street, Kambah ACT 2902.

LOW COST 1GHZ COUNTER (April 1993):

The text is incorrect in describing the decimal point interconnections between the main and display PCB's. The schematic, PCB overlay and photographs are correct. Also the PN4258 transistor has apparently been discontinued, but the 2N2894A or PN2894A should be suitable as a replacement — or in cases of difficulty, the BSR12. However the latter is in a very small (SOT23) surface- mount package, and the PCB may need to be modified to suit.

ANTENNA TUNER & RF PREAMP (November 1991):

The wire gauges specified for winding the coils are incorrect. Coils L1, L2 and L3 should be wound using 0.8mm wire, and coil L4 wound using 0.5mm wire. Also the MFE131 dual-gate MOSFET has been discontinued, but the BFR84 should be suitable as a replacement in this circuit.

SIGCHECKER (August 1993):

The 'HI' and 'LO' markings on the front panel artwork do not agree with the schematic and text. However if the markings are interpreted as meaning *current*, rather than impedance level, there is no need to change them.

BEYOND MEDIUMWAVE RADIO (August 1993):

The schematic diagram for this shortwave radio project showed a 3k:8 phm audio transformer, which should have read *1k*:8 ohm. This component was also missing from the parts list. ❖

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MJ2955 (PK.1)	$2.00	2N3055 (PK.1)	$1.50
IC's			
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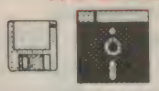

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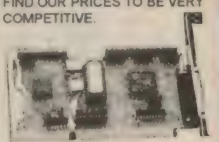

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READER INFO NO. 8

Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide further information.

Bi-directional PC port

The original IBM PC parallel printer port can be easily converted to full 8-bit bi-directional operation by simply cutting one track and inserting one wire, without effecting its normal operation as a printer port. Making a printer port fully 8-bit bi-directional significantly speeds up such applications as sound capture and synthesis, EPROM reading and burning, weather satellite picture processing, data logging, etc.

Most of these things can be done using the nibble mode, but the suggested modification makes the board work much faster, needs less peripheral circuitry, has simpler software, and preserves all the control leads for other functions.

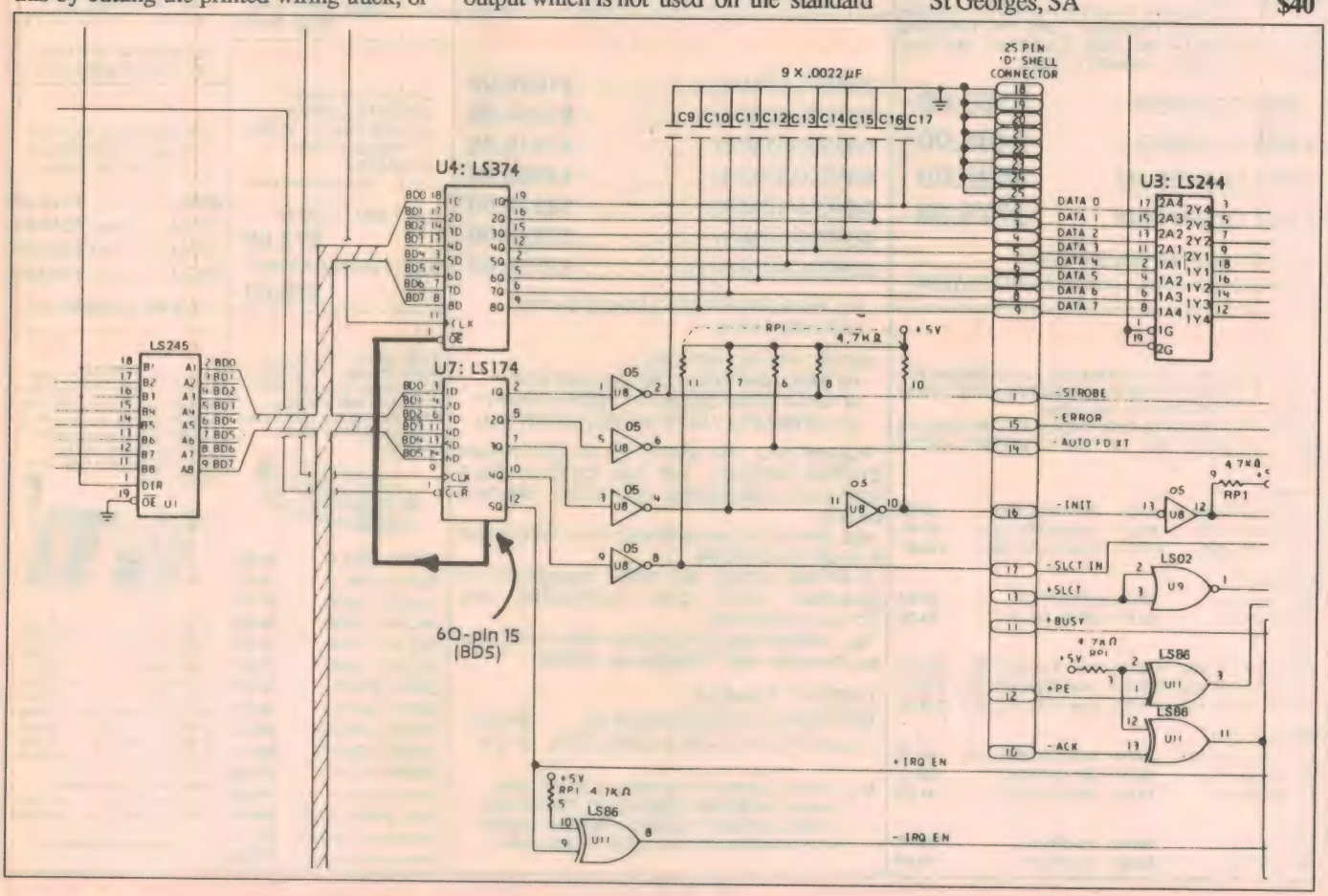
The conversion is done by first removing the earth on the active-low output enable (OE) pin of the 74LS374 (U4). Do this by cutting the printed wiring track, or cutting the pin at the board's surface and bending the pin out. Next, solder a wire from this pin to pin 10 or pin 15 of the 74LS174 (U7) — one of which should be spare, if the circuit is pin for pin compatible with the original IBM circuit.

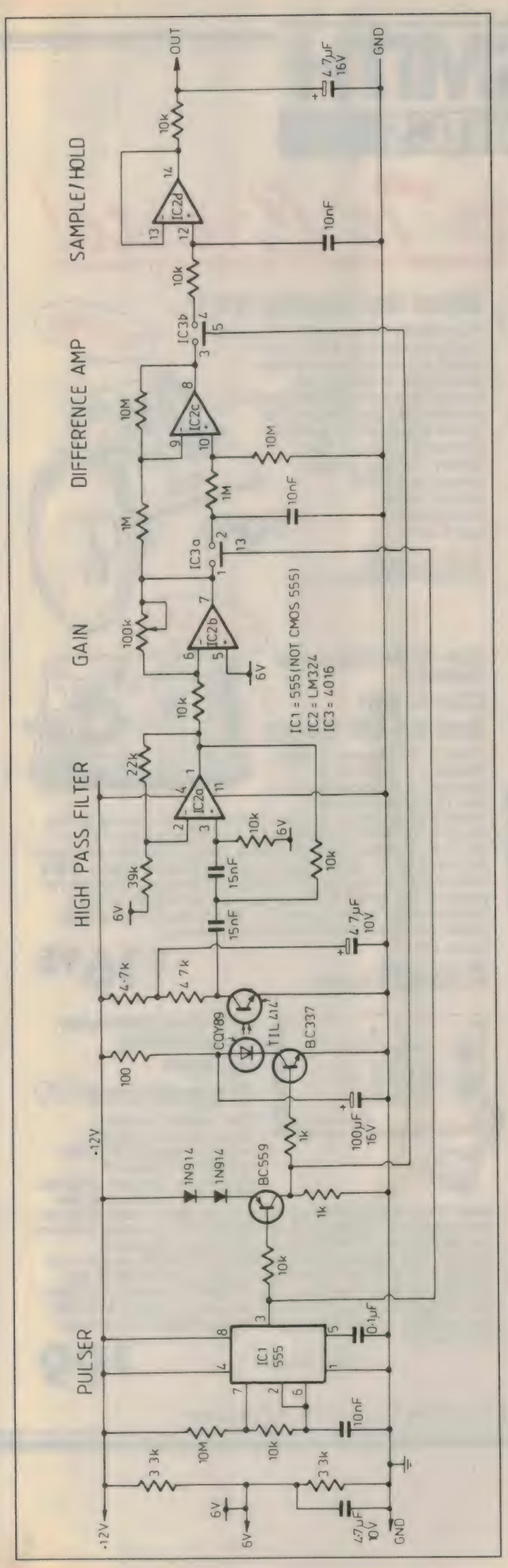
On a standard IBM compatible printer port, in normal operation, the outputs of the 74LS374 are permanently enabled and connected to the 8-bit parallel printer port. During boot up, a 74LS244 (U3) is used to read the 8-bit parallel lines while U4 drives them both high and low, in order to test for some common cable and printer faults.

If U4 is made high impedance by removing the permanent earth on its OE pin, then U3 can read any input data on that port. This can be done under program control whenever you want, using pin 10 or 15 of U7 — which is the unused bit 5 of the control port. Unbelievably, bit 5 is fully wired and addressable, except for its output which is not used on the standard IBM printer card. It is almost as if this feature were planned for original release and then taken off, or perhaps prepared for a future enhancement. You control this bi-directional I/O port from I/O address 37AH for LPT1 or 27AH for LPT2. Setting bit 5 low will operate the printer port as an output, while setting the bit high will make it an input.The addresses for input or output data are 378H for LPT1 or 278H for LPT2. The status port of 379H for LPT1, or 279H for LPT2, is unaffected by this modification.

Most PCs these days use IDE hard disk controllers that include one printer port, jumper selectable as either none, LPT1 or LPT2. You almost certainly will NOT be able to modify these cards. However, simple single-function printer cards using the original modifiable IBM circuitry are still available for about $20 from most computer suppliers.

Rick Matthews,
St Georges, SA **$40**





IR proximity detector

This infra red proximity detector is capable of detecting objects up to 1 metre away, and gives a voltage output which is proportional to the object distance. A 555 timer (IC1) produces 100us pulses every 100ms. (Do not use a CMOS 555.) The IR LED, driven by the BC559 and BC337 transistors, is only on for a very brief time, enabling currents of more an 1A to be passed.

This light pulse is reflected from an object, and then detected by a phototransistor. The signal is then fed to the low power quad op-amp LM324, where it is filtered by a high pass filter (IC2a), and amplified (IC2b). The output of IC1 which pulses the LED also controls two bilateral switches on IC3 (4016).

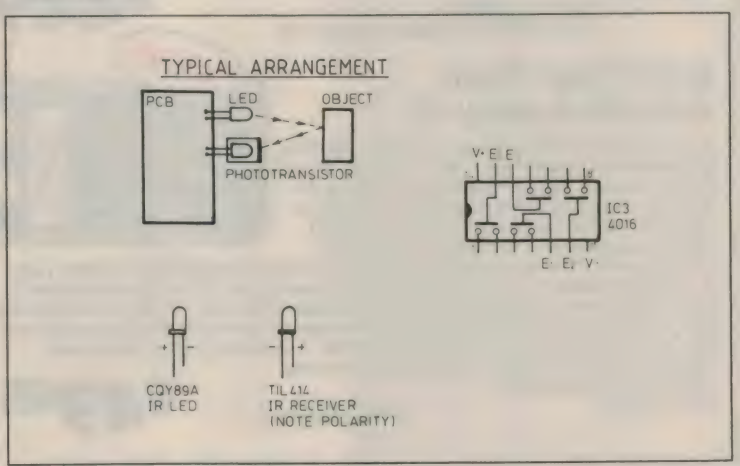
While the LED is off, the first switch (IC3a) is on and the second (IC3b) is off. IC3a on allows the background light intensity to be stored in the first sample/hold unit built around IC2c. When a light pulse is detected, switch IC3a turns off and IC3b turns on. Op-amp IC2c now acts as a difference amp, comparing the reflected pulse intensity with the background. This difference is amplified 10 times and stored in the second sample/hold unit built around IC2d.

As mentioned before, the final voltage output of the circuit is proportional to the distance between the transceiver and the object. The receiving circuit thus behaves as a bandpass filter with a pass band of only one frequency. Interference from fluorescent tubes is minimal.

Note that a metal tube is required around the phototransistor, as shown in the schematic. I used a TIL414 phototransistor (Tandy Cat. Z76145) as it was cheaper than a BPW50 photodiode.

The whole circuit can be run from 9 to 12V, and only draws a few milliamps.

James Moxham,
Urrbrae, SA **$50**



DREAMED UP A GREAT IDEA?

If you have developed an interesting circuit or design idea, like those we publish in this column, why not send us in the details? As you can see, we pay for those we publish — not a fortune, but surely enough to pay for the effort of drawing your circuit, jotting down some brief notes and popping the lot in the post (together with your name and address) and send them to Jim Rowe at -

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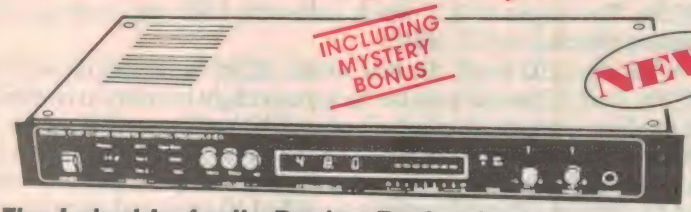

The Latest In Audio Design Technology!
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After you build this kit you can really sit back and enjoy the finished product. You won't have to leave your chair once you have the remote control in your hand! Use it to adjust volume and balance or to select the program from 6 signal sources (phono, CD, Tuner, VCR, Aux 1 and Aux 2 and tape deck). This convenient remote solves the limitations of conventional models. Because there are no moving parts in the volume control, there's no noise distortion when you alter the volume, additionally, the channel tracking emits no noise even at the lowest volume level. The front panel of the amplifier features green LEDs to indicate settings made via the remote control as well as the selected program source. Comes complete with all components hardware ,PCB's,deluxe pre-punched case ,pre-punched screened front panel and a deluxe remote control case and front panel to suit.
Cat K-5550

$449

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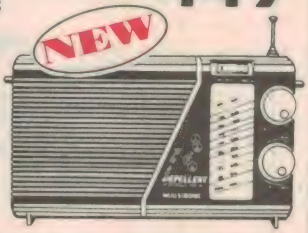
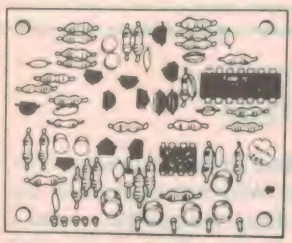
Build Your Own AM/FM Radio!



If you're intrigued by the way a radio works, this is the ideal kit to learn from. With the help of our comprehensive instructions, all you have to do is solder the components onto the circuit board, assemble all the hardware bits and you'll end up with a professional looking and sounding AM/FM radio. Your friends won't believe you built it yourself - the portable radio is very impressive with a large speaker for great sound. Plus, it runs on three 'C' sized batteries for long-life and is water resistant. It's a simple alignment process due to the single IC circuit, though some experience with soldering is necessary. The kit comes complete with all components, hardware, plastic casing with rubber seals, carry strap and telescopic antenna.
(Batteries not included.)
Cat K-1042

EA Oct '93

$49.95



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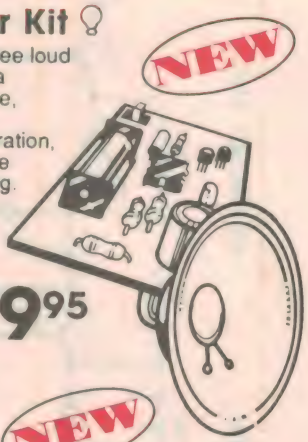
ACS Decoder

Now you can get more from your favourite FM radio stations! By taking advantage of the Ancillary Communications Service (ACS) that's employed by many FM broadcasters, you'll be able to listen in to special-purpose channels. These channels are only accessible by an ACS decoder. Everything is mounted on a single PC board that's compact enough to fit in most small receivers - it operates on a supply between 6V to 30V. Instructions show how to install the ACS decoder into our A-5235 Digitor AM/FM portable stereo. Kit will be supplied in short form with PCB and components only.
Cat K-5020

EA Sept '93

$18.95

Siren Generator Kit



A simple kit that provides three loud siren sounds! Just a flick of a switch will sound either police, ambulance or fire engine sirens. With just a slight alteration, you can also get it to emit the sound of a machine gun firing. Operates on just 1 "AA" battery. Comes with all components,PCB, battery holder and speaker.
Cat K-5514

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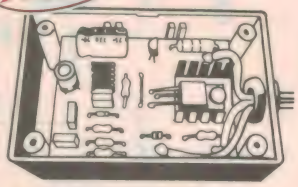
Silicon Chip Nov '93

Sick Of Getting A Flat Battery?
Car Light Switch-Off Timer



There's nothing worse than returning to your car to discover that the battery is flat. This scenario often caused by leaving your car's internal light on, either by not shutting the door properly or by simply forgetting to turn it off. That dreaded feeling will be a thing of the past once you build this kit! By connecting it with the positive supply to the interior light circuit, the light switch-off timer can control the power to the lamps and automatically turn them off after approximately two minutes. The kit comes complete with plastic case, hardware and all components.
Cat K-4212

$16.95

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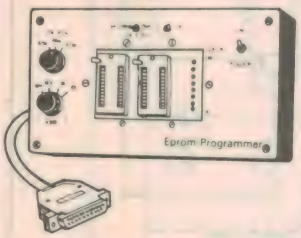

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Ever wanted to write instructions to control a microprocessor? With this sensational piece of equipment, you can program EPROMS the inexpensive way! The flexible and powerful programmer is controlled via the parallel port on an IBM compatible PC. It not only allows you to program EPROMs but it also has a readback feature. The hardware can handle EPROMS from 2716 (2K x 8) to 27256 (32K x 8) and it will also program 2816 and 2864 electrically erasable (EE) PROMS. Comes in full form with all components, hardware including 2 quality EPROM test sockets, case and pre-punched screened front panel.
Cat K-3602

EA Oct '93

$99

Please Contact Your Nearest Store For Availability As Some Kits May Still Be In Production.

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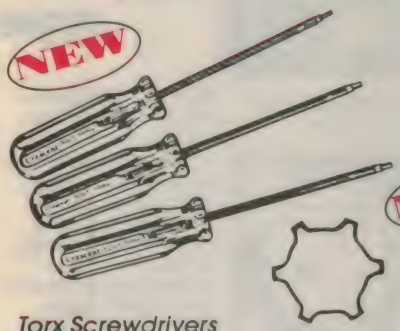

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Talking Screwdrivers?

Ever heard of a screwdriver that torx? If so, consult your local doctor. These are special screwdrivers that can undo just about anything (so long as it torx, too).(Pack of three)

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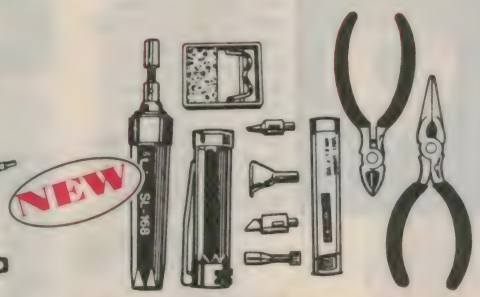

Compact Soldering Kit

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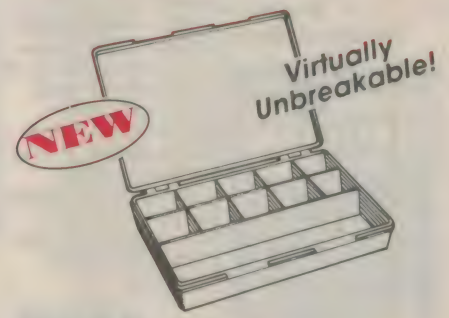

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Car Security Alarm Hybrid I.C

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Cat Z-6190

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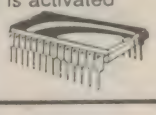

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Plug this lead into your computer or any other electrical appliance for protection against surges and spikes caused by unpredictable hazards such as lightning. It not only guards valuable electronic goods against permanent damage, it also automatically re-sets after absorbing a surge, unlike most which need to be replaced after the shock of one. Additionally, the safety lead features a green safety neon to indicate when the power is on and can protect any number of appliances on a power board or power point.

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Cat L-5342

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We Have All The Answers!

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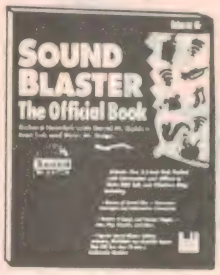
Sound Blaster - The Official Book



The one and only book written by sound Blaster manufacturers' Creative Labs, it covers the whole family of sound blaster cards including Sound Blaster Pro, the new Sound Blaster 16 and the Soundblaster Multimedia Kit. Comes complete with a 3.5" disk packed with information and utilities.

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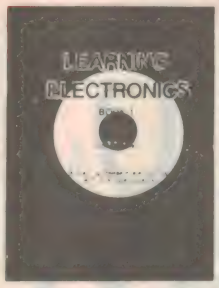

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Learning Electronics Book 2 Cat B-3672

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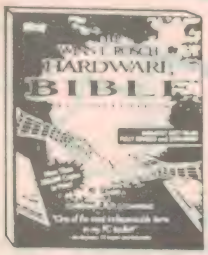

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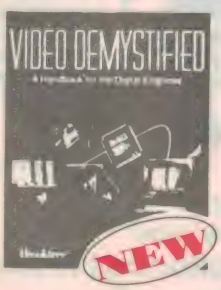

This comprehensive volume explores the relationship between video and computer graphics and examines the essentials of today's video standards as well as contemporary applications. With the aid of its illustrations, you'll find it easy to understand.

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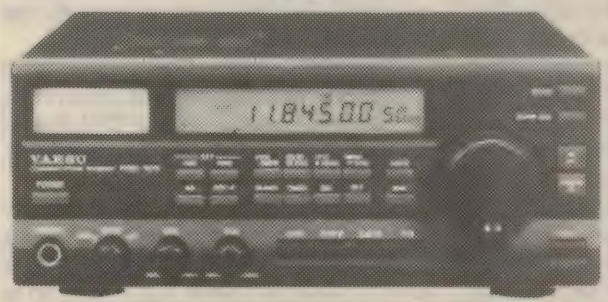

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Yaesu FRG-100 Receiver

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Construction Project:

LOW COST TV-DERIVED FREQUENCY REFERENCE - 2

Here are the full constructional details for the author's 'poor man's rubidium standard', introduced last month. Also given is a detailed circuit description, plus all the information needed to set it up and use it.

by JIM ROWE

The new TV-derived reference works by removing everything but the horizontal sync pulses from the incoming composite video signal, and feeding these to a flipflop to produce a squarewave signal of 7.8125kHz — exactly half the video line frequency. A similar but separate 7.8125kHz squarewave is produced by a digital divider chain, from a local 10MHz crystal oscillator.

The two squarewaves are then fed to a phase comparator, to produce a DC error voltage which is proportional to the phase difference between the two. By feeding this error voltage to a variable capacitance diode in the crystal oscillator, the whole arrangement forms a phase-locked loop which 'pulls' the crystal into phase lock with the incoming signals.

That's the basic idea; now let's look at the schematic, to explain it in more detail.

The incoming composite signals are first fed through a simple low-pass filter (R2 and C2), to reduce the chrominance and colour-burst levels so that these components don't complicate matters. Then the signals pass to Q1, which forms a simple but effective sync separator. This removes virtually all of the luminance and chrominance information, so that only the sync signals are present in the voltage across R4.

As it is the *leading edges* of the sync pulses which convey the crucial horizontal timing information, these edges are isolated by using them to trigger one-shot U1a (half of a 74HC221).

This essentially retains their timing (apart from a tiny and constant propagation delay), but converts them into a stream of narrow pulses about 4us wide.

Most of these pulses are at the 15.625kHz TV line frequency, but there are some additional pulses present due to the 'equalising' pulses present in the TV signal's vertical sync block. To prevent these extra pulses from disturbing our phase-locking system, they are gated out.

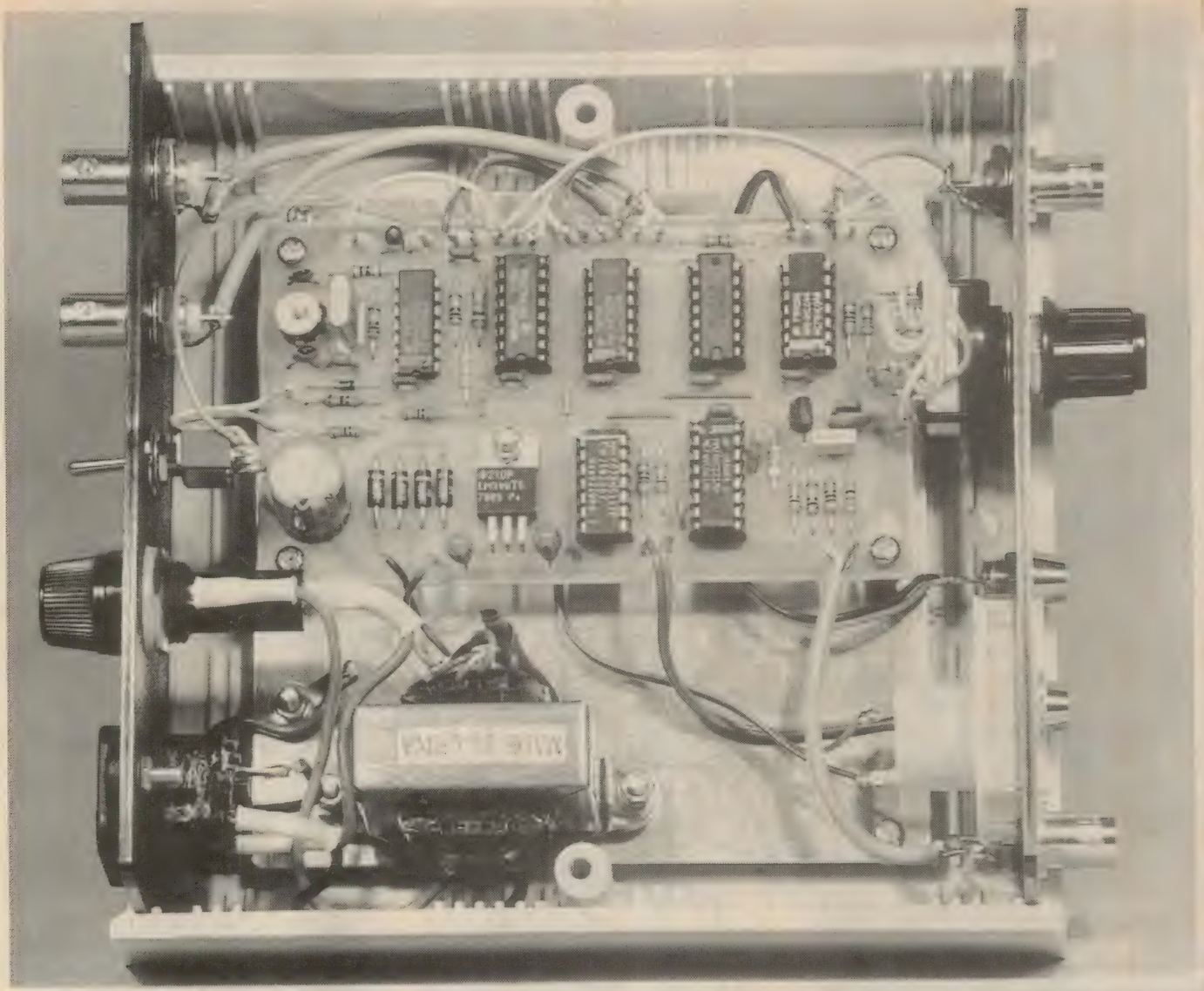
This is done by triggering a second one-shot U1b, from the *trailing* edge of the 4us pulses produced by U1a. The pulses produced by U1b are about 45us long, and by feeding those at the Q-bar output of U1b to gate U3d, along with the pulses from the Q output of U1a, we arrange for all of the additional pulses to be removed. Only the desired 15.625kHz pulses emerge from U3d, in a steady and unbroken stream.

Gate U3a is then used as an inverter, to trigger flipflop U2a on the leading edge of these pulses and hence use them to produce our 7.8125kHz squarewave reference signal. (Why do we divide down to 7.8125kHz, rather than do our phase comparison at 15.625kHz? Simply because the type of phase comparator we're using works best with symmetrical squarewave signals, and a flipflop provides the simplest and most reliable way to convert our pulses into such a signal.)

Now let's see how the *local* 7.8125kHz signal is produced. The crystal oscillator is based around U4d, one of the four ex-OR gates of a 74HC86 chip, used here as an inverter.

This provides the gain and phase inversion necessary to make our 10MHz crystal oscillate, with components R18 and C17 used to ensure that it does so in its fundamental mode rather than on an overtone. C17 also helps tune the crystal

On the back panel are mounted the IEC mains input connector and fuse holder, plus the PLL adjust/lock switch and two BNC connectors used to make available both the TV derived and locally generated 7.8125kHz signals for comparison.

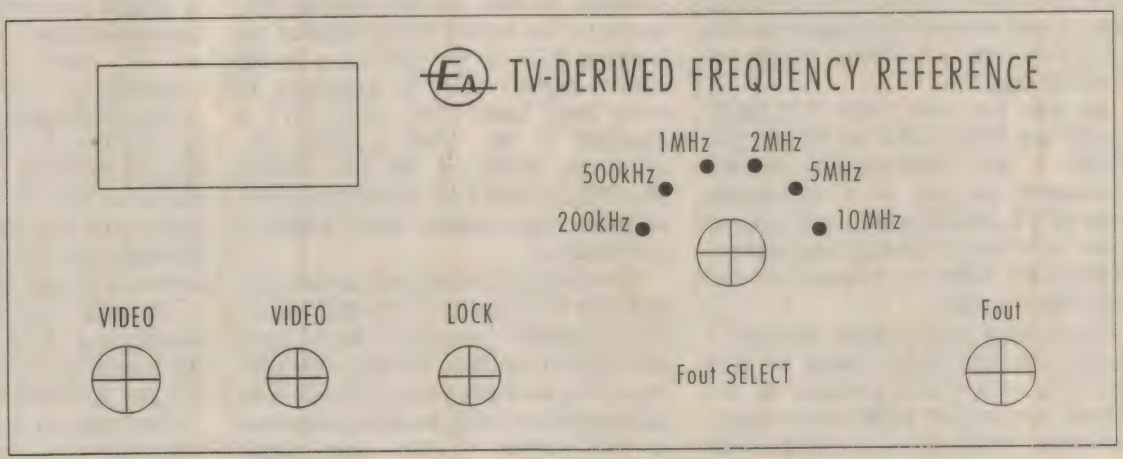


This general view inside the unit shows where everything goes, and should be used as a guide when you are assembling your own. Most of the parts mount on a single PC board, which measures only 110 x 65mm. Both the PCB and the small power transformer are supported inside the plastic case by an aluminium plate measuring 110 mm square.

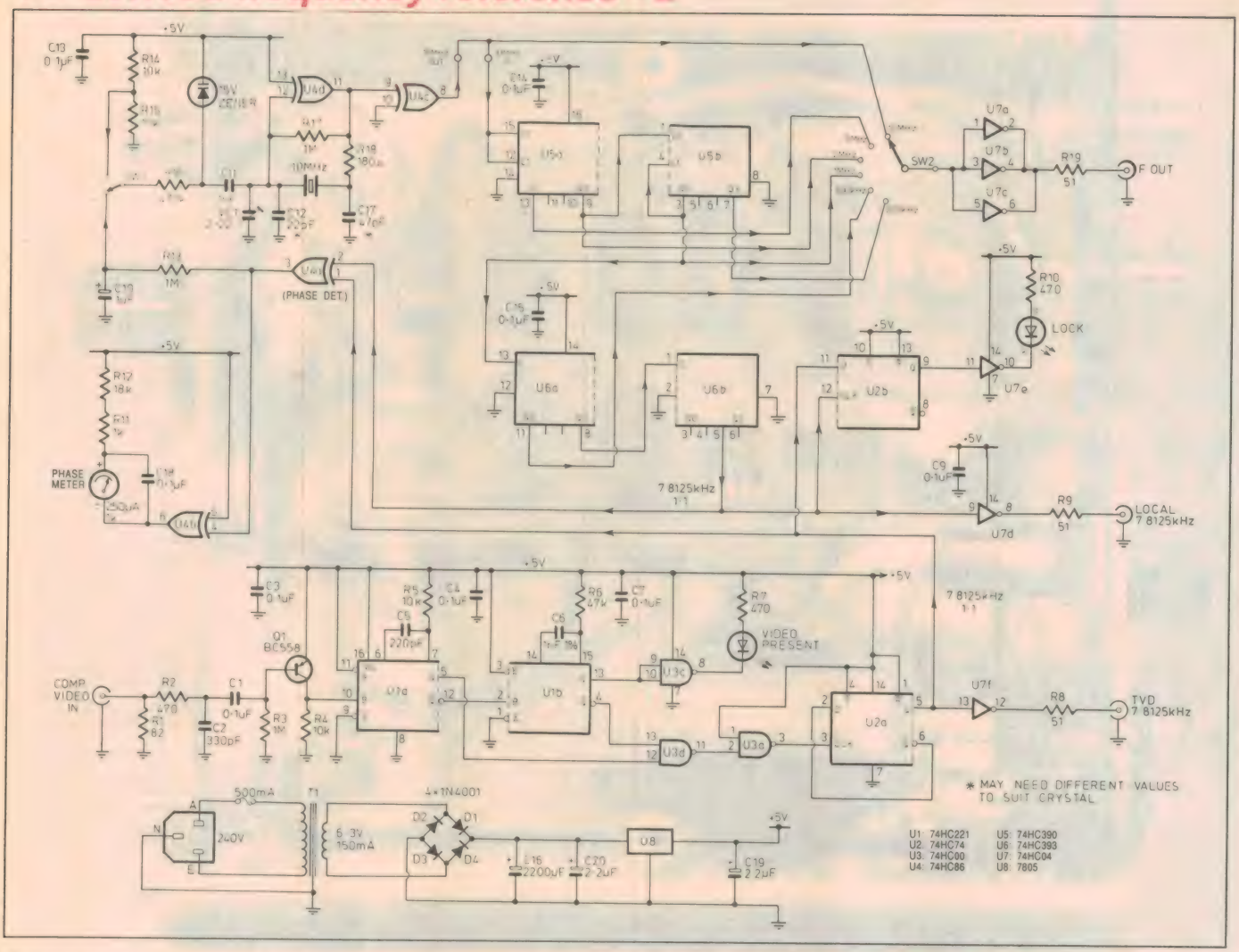
to the correct free-running frequency, along with C12, trimmer cap VC1 and the 15V zener diode (which is used here as a varicap).

The 10MHz output from U4d is passed through U4c, which is configured as a non-inverting buffer. This provides the 10MHz output signal for output selector switch SW2, as well as the input signal for U5a, the first frequency divider stage (half of a 74HC390). The output of U5a is then fed to U5b, and this in turn feeds U6a and U6b (both halves of a 74HC393), forming the rest of the divider chain. From these divider

Here is the artwork for the front panel, reproduced here actual size for those who wish to make their own from Dynamark photo-sensitive aluminium sheet . A photocopy can also be used as a template when you're drilling the front panel.



TV-derived frequency reference - 2



As you can see from the schematic, the frequency reference involves only eight low cost ICs. It is designed to accept standard composite video signals from a VCR or modified TV receiver.

stages we produce the 5MHz, 2MHz, 1MHz, 500kHz and 200kHz output signals, all derived from the 10MHz crystal oscillator.

Also, and most importantly, we pick off from pin 5 of U6b an all-important 7.8125kHz squarewave, again derived from the 10MHz crystal. This of course is the signal we need to compare against the TV-derived 7.8125kHz signal, for phase locking.

As you can see, both 7.8125kHz signals are fed to U4a, an ex-OR gate which is the main phase detector. The output of U4a is a rectangular wave of 5V peak to peak, with a mark-space ratio that is directly proportional to the phase difference between the two 7.8125kHz signals.

By passing this signal through a simple low-pass filter formed by R13 and C10, with a time-constant of one second, we produce a DC error correction signal which is fed to switch SW1, ready to control the crystal oscillator and complete the phase-locking loop.

Resistors R14 and R15 form a simple voltage divider which develops a fixed +2.5V DC voltage, also fed to SW1. This voltage is fed to the zener diode 'varicap' when SW1 is in the 'ADJ' position, so that the free-running frequency of the crystal can be adjusted via trimmer VC1, to be very close to the correct figure. (This is explained in more detail later.) Then, when SW1 is switched to the 'Lock' position, the corrective action of the DC voltage developed across C10 'pulls' the crystal oscillator into reliable lock, within a few seconds.

How can you be sure that the loop *has* correctly locked, and is staying in lock? Two separate indicators have been provided in the unit, for this very purpose. One consists of gate U4b, wired as an inverter and with its input connected to the output of the main phase detector U4a. The output of U4b is again a rectangular signal of 5V peak-to-peak, and this is used to drive a small low-cost 250uA meter movement, via resistors R11 and R12 and with C16 used for filtering.

This arrangement turns the meter into a simple but very effective phase difference indicator. When the loop is locked, it gives a steady indication; otherwise it will give an indication which continuously 'oscillates', at a fast or slow rate. For the most reliable locking the oscillator trimmer is simply adjusted so that the meter needle remains steady and near the centre of the scale, showing that the loop is locked in the centre of its hold-in range.

The other indicator of correct phase locking is a second type of phase detector, formed by flipflop U2b which drives a 'Lock' LED via inverter U7e.

This detector relies on the fact that when the main loop is in lock, the two

7.8125kHz signals have a fixed phase relationship, with the TV-derived signal always 'high' on the rising edge of the locally-derived signal. (In fact when the loop is locked in the centre of its hold-in range, there is a fixed 90° phase shift between the two signals, with the TV-derived signal *leading*.)

By feeding the TV-derived signal to the D input of U2b, and the local signal to its clock input, the flipflop will be kept continually in the 'set' state whilever this steady phase relationship exists, and the Lock LED will glow continuously. But if the loop loses lock and the phase relationship between the two signals begins changing, the LED will begin flashing on and off, in a cyclic fashion — which actually corresponds to the beat frequency between the two.

Actually, I've also provided for a *third* way to monitor the locking of the loop. Both the TV-derived and local 7.8125kHz signals are passed through inverting buffers (U7f and U7d respectively), and made available via BNC sockets on the rear of the unit. This allows you to feed them to a 'scope, and check their phase relationship directly if you wish.

That's almost it, in terms of the unit's schematic. Gate U3c is used as an inverter, driven from the Q output of one-shot U1b and driving in turn a green LED marked 'Video'. As both U1a and U1b only trigger in the presence of sync pulses, this LED only glows when video is present at the input to the unit — a handy additional check as to correct operation.

Switch SW2 selects the desired output signal frequency from the reference unit, and paralleled inverters U7a-c are used as an output buffer. As the whole circuit operates from +5V DC and draws a very modest current (thanks to the use of HCMOS devices), the power supply is a very simple arrangement using a 6.3V/150mA transformer, a bridge rectifier (D1-D4) and a three-terminal 5V regulator (U8). The regulator does not need a heatsink, and is bolted directly to the PC board.

Incidentally there's no reason why the complete unit couldn't be operated from batteries, for use away from AC mains power. All you'd need to do is leave out the mains transformer, and feed the board from a 9V battery. The current drain into U8 is only about 35mA.

Construction

As you can see from the photos, the complete TV-derived Frequency Reference is housed in a small plastic instrument case, measuring 160 x 155 x 65mm. Apart from the meter, power transformer, switches, LEDs and connectors, all of the circuitry fits on a small PCB measuring only 110 x 65mm, and coded 93tvf8.

The meter, indicating LEDs, video input socket, frequency selector switch SW2 and output socket are mounted on the front panel, while the adjust/lock switch SW1 and 7.8125kHz output sockets are mounted on the rear panel along with the IEC mains input connector and mains fuse holder.

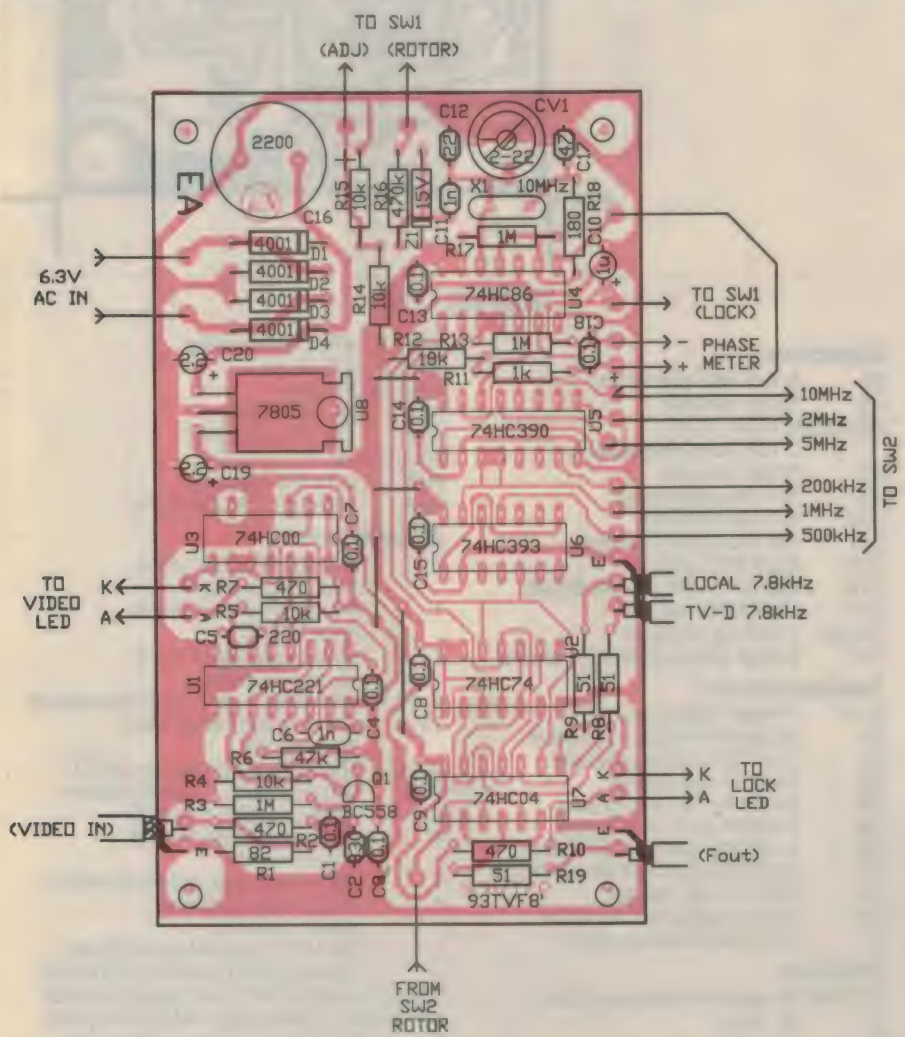
Inside the case, the PCB and the mains transformer are both mounted on a plate of 1mm thick aluminium sheet measuring 110mm square, mounted in the lower half of the case via self-tapping screws. The plate is connected to mains earth, and forms a shield plate for the PCB as well as a convenient support for both it and the power transformer. The PCB mounts on the plate via four tapped insulating spacers, 10mm long.

Although there's not much room to spare on the board, it's not unduly crowded. Fitting all of the components should be fairly straightforward if you use the PCB overlay diagram and internal photo as a guide.

As usual, it's best to start with the PCB terminal pins and links, then the resistors and small capacitors (including the trimmer), followed by the diodes and larger electrolytics, and finally the crystal, transistor and ICs. Take the usual care with the polarised parts, to orientate them correctly.

Although sockets were used for most of the ICs on the prototype board, with the exception of U4 (which should *not* have one), this was only done to facilitate testing. I suggest you fit all of the ICs directly to the PCB, for greater reliability.

There are not all that many connections between the board and the off-board components, and these should be fairly clear from the overlay/wiring diagram and internal photo.



This overlay/wiring diagram indicates not only where all of the minor components fit on the PC board, but also shows virtually all of the connections between the board and the remaining major components.

TV-derived frequency reference - 2

Note that the 10MHz output from the crystal oscillator buffer (near R18) is connected to both SW2 and the divider input pin, near U5. The rest of the connections to SW2 run from the pins alongside U5 and U6 — but note that they are not in strict decending-frequency order.

Two of the connections for Adjust/Lock switch SW1 run from the rear of the board, near R15 and R16, while the third ('Lock') wire runs from the side of the board near U4 and C10.

The meter movement is not provided with mounting screws for mounting it to the front panel, so I used a few drops of 'MultiGrip' plastic adhesive on the lower part of the meter case, to glue it in place. The front panel was dressed up using a Dynamark photo-sensitive sheet, and the artwork used is reproduced here for you to make a replica if you wish. The PCB artwork is also provided for the same purpose.

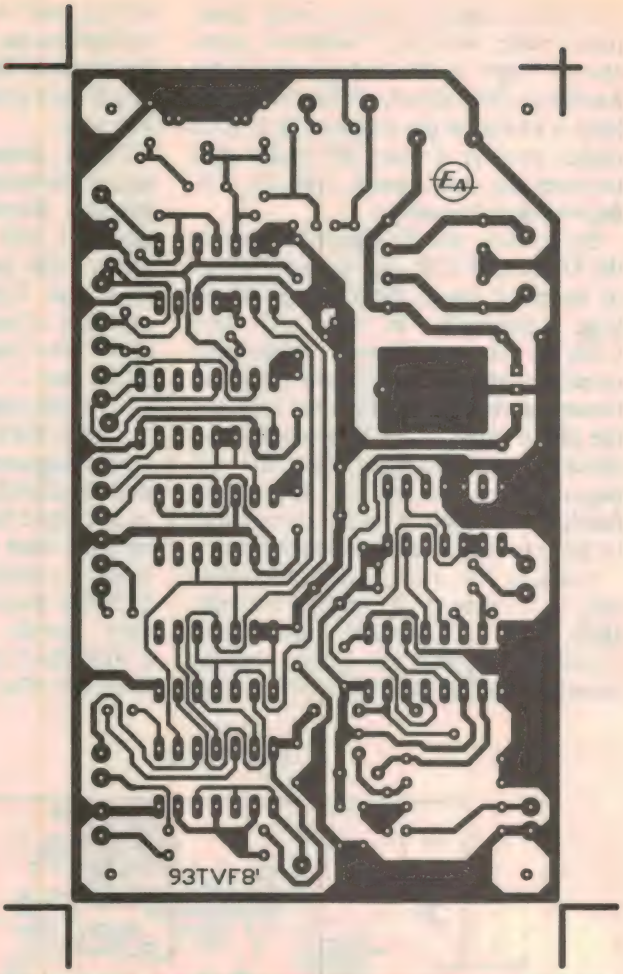
The only other point to note is that the mains connector earth pin should be connected directly to a solder lug bolted to the metal shield plate, under the fuse holder, using a sturdy wire with the correct green/yellow striped insulation. The remaining mains wiring should be made in mains-insulated wire (blue for neutral, brown for active), with the active wire from the IEC connector going to the *rear* lug of the fuse holder and all connections sleeved with either varnished cambric or heat-shrink plastic, to prevent accidental contact.

Setting it up

The first thing to do when the unit is completed is set trimmer capacitor VC1 to about the middle of its range. Then apply power, and check that U8 is delivering the correct +5V to the rest of the circuitry. If all is well, set the Adjust/Lock switch SW1 to the Adjust position, and apply composite video (at the standard 1.4V p-p level, with negative sync) to the video input. This should cause the green 'Video' LED to glow steadily.

In all probability, the red 'Lock' LED will begin flashing fairly rapidly, and the meter's needle will be swinging up and down over the scale, at the same rate. The rate of flashing and meter swinging is an indication of how far apart in frequency the two 7.8125kHz signals are — it's essentially their beat frequency.

Now try adjusting VC1 with a small screwdriver or alignment tool, in one direction or the other, to see which direction reduces the beat rate. It should



As usual, here's the artwork for the PCB itself, reproduced actual size for those who wish to etch their own boards.

PARTS LIST

Capacitors

C1	0.1uF MKT plastic film
C2	330pF ceramic
C3,4,7,8,9,13,14,15,18	0.1uF monolithic ceramic
C5	220pF ceramic
C6	1nF 1% polystyrene
C10	1uF tag tantalum
C11	1nF monolithic ceramic
C12	22pF NPO ceramic
C16	2200uF 16VW RB electrolytic
C17	47pF NPO ceramic
C19,20	2.2uF tag tantalum
CV1	2-22pF plastic dielectric trimmer

Semiconductors

D1-4	1N4001 silicon rectifier
Q1	BC558 PNP silicon transistor
U1	74HC221 dual monostable
U2	74HC74 dual flipflop
U3	74HC00 quad NAND gate
U4	74HC86 quad ex-OR gate
U5	74HC390 dual decade divider
U6	74HC393 dual 4-bit binary divider
U7	74HC04 hex inverter
U8	7805 or similar 5V regulator
Z1	15V 400mW zener diode

Resistors

All 1/4W 5% carbon unless specified:

R1	82 ohms
R2	470 ohms
R3	1M
R4,5,14,15	10k
R6	47k 1% metal film
R7,10	470 ohms
R8,9,19	51 ohms
R11	1k 1% metal film
R12	18k 1% metal film
R13,17	1M 1% metal film
R16	470k 1% metal film
R18	180 ohms 1% metal film

Miscellaneous

1	Plastic instrument case, 160 x 155 x 65mm
1	PC board, 110 x 65mm, code 93tvf8
1	110mm square of 1mm aluminium plate
1	250uA/1k 'signal' meter movement
T1	Small power transformer, 6.3V/150mA
SW1	Miniature toggle switch, SPDT
SW2	Rotary switch, 1 pole 6 position
X1	10MHz crystal, HC-49/U
4	BNC socket, single hole panel mount
1	IEC mains plug, panel mounting
1	3AG mains fuseholder, panel mounting
1	Red LED in panel-mount bezel
1	Green LED in panel-mount bezel

Control knob for SW2; four tapped insulating spacers, 10mm long, with screws; four 3mm x 10mm long machine screws, with matching nuts and lockwashers; solder lug; light duty 50-ohm coaxial cable; hookup wire, solder, etc.

be possible to reduce it to a very low rate, indicating that the crystal is now oscillating at very close to the correct 10MHz. Further adjustment in the same direction should then 'pass through' the minimum, so that the beat starts increasing again. (Be careful, though — make sure you don't get a 'false' minimum at one extreme or the other of VC1's adjustment range.)

If you reach the maximum or minimum setting for VC1 and this clearly defined 'minimum beat' condition can't be achieved, your crystal's frequency may be near one of the extremes of the tolerance range, and you may need to replace fixed capacitor C12 (and possibly also C17) with the next higher or lower value (indicated by which extreme of VC1's adjustment range your false minimum occurs at). With one or two of the low cost 10MHz crystals I tried, I needed to reduce C12 down to 15pF; one crystal even needed C17 changed to down to 39pF, as well.

Once you have achieved a true 'minimum beat' condition, switch SW1 over to the Lock position. Within a few seconds, the Lock LED should stop flashing and glow steadily. The meter needle should also stop swinging, and settle down to a position roughly halfway up the scale. Your loop will now be in lock, as a 'scope connected to the two rear outputs will reveal.

To ensure the most reliable operation, trimmer VC1 may need a slight tweak to ensure that the meter needle stabilises as closely as possible to the centre of the scale, when the unit has been operating for a while and the temperature stabilises. Once this is done your TV-Derived Frequency Reference is set up and ready for use, so you can fit the top half of the case properly.

As the crystal gradually ages, after months of use, you'll notice that the 'locked' position of the meter needle will very slowly drift away from the centre position. When it has drifted significantly away, you'll need to open the case again and give VC1 a further tweak to bring things back to the optimim setting.

Otherwise, using the unit will simply involve switching it on, feeding it with video from your VCR, and waiting a few tens of seconds until it has locked and stabilised. Then your 'poor man's rubidium frequency standard' will be ready for use.

And how do you put it to use? Well, there are two basic ways. To use it for calibrating things like frequency counters, all you need to do is connect its main output signal (set for a suitable frequency) to the counter's input. Then it's basically just a matter of adjusting the counter's timebase trimmer, if necessary, until it reads the correct frequency as accurately as possible.

To use the reference for calibration of signal generators and other signal sources, the easiest approach is to feed its output signal into a counter's 'external timebase' input, so that it effectively becomes the counter's own reference. Then the counter can be used in the normal way to measure the frequency from the generator or source — except that its accuracy will now be much higher than usual.

Those readers who have built my Low Cost 1GHz Counter, as described in the April 1993 issue, may be interested to learn that I've worked out a simple add-in circuit which not only adapts it to accept an external timebase (from the TV-Derived Reference, for example), but also gives it an optional 10-second/5.12-second extended gating time for higher-resolution measurements — so you can take advantage of the higher timebase accuracy. This is already working, and will be described shortly. ❖

You'll find it at the Patent Office

Continued from page 21

A quick flip through gives 'Lasers H01S', as before. Out of interest, the next entry is 'Severing non metallic materials by laser B23K 26/00'. So if you have no clue where to start looking, the Catchword Index is your best bet.

Go on, use it!

And that's basically it. Once you've found the appropriate IPC mark, it's simply a matter of looking through the relevant folder of abstracts at the Patents Sub-office. The only pitfall here is that abstracts tend to consist of a diagram plus a 'claim' or two.

Claims are the legal part of the patent, which 'in a single sentence define the scope of the monopoly sought', to quote roughly from the various office pamphlets.

My advice is to ignore the claims as much as possible and puzzle out most of the invention from the diagram. Try to get some intelligence from the claims, but don't be dismayed if you can't — legal jargon is sticky stuff. Then make a list of the patent specifications you want and copy away, or else order what you want from the Patent Office in Canberra at $15 a pop, including postage.

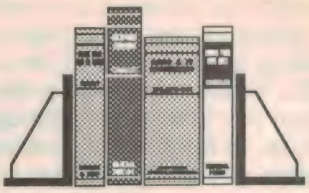
So, as all the sporting ads say, just do it. It is a crime to let such a body of information sit and stagnate. I have it on good authority that the Japanese have learned to use the system to its maximum.

As soon as a patent becomes OPI, they have it on their desk and are dreaming up the next generation. You don't want to be left behind, do you?

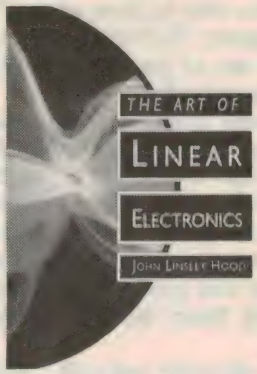
What's more, you are probably reading this because you're the inventive sort yourself. And when the time comes to design that improved rodent incarceration device, you don't want to waste large chunks of your life boldly going where others turn out to have already been before. Reviewing the existing patents is the best way to make sure of this.

Postscript: The name of the Patents Office has recently been changed to the Australian Industrial Property Organisation (AIPO), pronounced Ape-Oh. Who said comedy was dead? ❖

NEW BOOKS



Analog design...



THE ART OF LINEAR ELECTRONICS, by John Linsley Hood. Published by Butterworth-Heinemann, 1993. Soft cover, 245 x 190mm, 336 pages. ISBN 0-7506-0868-4, RRP $49.95.

Respected British electronics author and engineer John Linsley Hood has produced this book in an effort to encourage both new and experienced engineers into the world of linear electronics. The current strong emphasis on digital electronics, Hood believes, has caused a shortage of engineers with broad skills in analog design.

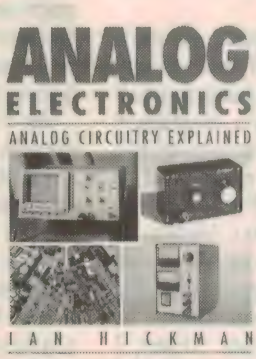
As *his* contribution to the task of redressing this imbalance, Hood has attempted to cover each of the principal aspects of linear circuits and techniques in outline, so that those who would like a fuller knowledge of a particular subject are then well equipped to tackle more specialised books on that field. He certainly seems to have achieved these aims, and the book could well become a standard text for linear techniques in electronics engineering courses.

The chapters cover the basic devices of all circuits (passive, then active components) through to the various types of analog design (amplifiers, oscillators, radios, power supplies, test instruments and so on). There are many illustrations, and commendably little jargon.

The writing style is in fact refreshingly down-to-earth, and the author pays particular attention how the various techniques are used in practical, everyday situations. In this respect, he has included a large number of basic circuits of commercial designs, including several his own well-known amplifier circuits — most of which were originally presented in the UK-based *Wireless World* magazine.

The book will suit the newcomer to linear circuits in particular, and draws heavily on the author's considerable experience in the rather curly world of analog circuit design.

The review copy was supplied by Butterworth-Heinemann, at 271-273 Lane Cove Road, North Ryde 2113; copies should be available through technical bookstores. (R.E.)



...and circuitry

ANALOG ELECTRONICS, by Ian Hickman. Published by Newnes, 1993. Soft cover, 245 x 190mm, 332 pages. ISBN 0-7506-1634-2. Recommended retail price $45.95.

The aim of this book is to take readers 'inside' electronic circuits so that they can see what makes them tick. Its audience is those already involved in electronics, either as a hobby or professionally: students, technicians and graduates. Despite including many examples from the author's large collection of circuits built up over 30 years working in the area, the book is completely up-to-date with the latest developments.

Several approaches to circuit analysis are used (vector diagrams, Bode plots, pole-zero diagrams, etc.), revealing the identical principles behind each. These are applied to practical analog circuits, useful in a wide range of applications.

Topics covered include passive and active components and circuits, audio-frequency signals and reproduction, signal processing and transmission, RF circuits, signal sources and power supplies. The final chapter gives a selection of 'tricks of the trade', both theoretical and practical. The 11 chapters are followed by eight appendices, which give a lot of useful electronic information — from the range of resistors of various tolerances to normalised values for T and pi pads.

While not strictly a textbook, the fundamentals of electronic design are fully covered, and a concrete, rather than a mathematical approach is used. I found that the book was very readable and well illustrated with graphs and explanatory diagrams. A very useful reference.

The review copy came from Butterworth-Heinemann, 271-273 Lane Cove Road, North Ryde 2113. It should be available from technical bookshops. (P.M.)

Nature revealed

LIGHTNING PROTECTION FOR PEOPLE AND PROPERTY, by Marvin M. Frydenlund. Published by Van Nostrand Reinhold, New York, 1993. Hard covers, 235 x 155; 229 pages. ISBN 0-442-01338-8. Recommended retail price $109.95.

One of nature's most awesome spectacles, the 'thunderstorm', is now explained in detail, not only for the engineer, but also for any interested general readers...

Myths and superstition are explored, and Benjamin Franklin's experiments described, in this well written and clearly expressed text. You really do find out what causes thunder and lightning, and the effect it has on the atmosphere, humans, animals, plants and structures.

The author then explores various forms of protection taken in the past and brings you up to date with the latest scientific thinking and devices necessary to ensure adequate, if not complete, protection from lightning strikes.

For general reading, a fascinating look at nature; for the student, a wealth of knowledge; and for the engineer, valuable insight into a subject which is generally misunderstood and barely covered by most educational institutions. While considered to be a little expensive, it provides a great deal of knowledge.

The review copy came from Thomas Nelson, 102 Dodds Street, South Melbourne 3205. (M.R.G.) ❖

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Provides ten signal outputs with only one PC system - 1 VGA input to 10 VGA outputs Ideal for schools & factories
1024 x 768 - 1280 x 1024 res $595.00

25% OFF ALL COMPUTER CABLES AND AUDIO LEADS THIS MONTH

DYNAMO & SOLAR AM / FM RADIO

With 4 way power back-up - doesn't need batteries.....$39.95

CANNON BRAND EP - S TONER CARTRIDGES

CITY STORE ONLY

9 ONLY BRAND NEW OUT OF DATE STOCK..$89.00

SHAREWARE SOFTWARE

OVER 1500 TITLES TO CHOOSE FROM. ONLY $3.95 FOR A 5¼" DISK
SHAREWARE CAT. $3.95

MEMORY	1-9	10-99	100+
41256-08	$4.95	$4.75	$4.50
44256-07	$11.95	$10.75	$9.95

SIMMS	1-9	10-24	25+	100+
1M x 9-60	$129	$125	$120	$115
1M x 9-70	$99	$93	$92	$89
256K-70	$39	$37	$35	$33
4M x 9-70	$339	$335	$329	$325
4M x 9-60	$449	$439	$429	$419

NEW 72 pin RAM Modules
4 MEG RAM.....$489
8 MEG RAM.....$938
16 MEG RAM.....$1,619

HARD DRIVE SPECIALS 2 Yr W'TY

SEAGATE DRIVES. Ring for latest prices.

Cap	Voice.C	Av.Acc	Brand	Tax Inc.	Tax Ex.
89M	YES	14ms	SEA	$309	$254
131M	YES	16ms	SEA	$329	$270
212M	YES	16ms	SEAMAX	$379	$310
260M	YES	16ms	SEA	$459	$379
345M	YES	12ms	WD	$579	$478
420M	YES	12ms	WD	$799	$660
540M	YES	12ms	SEA	$1199	$998

HERE'S JUST A SMALL SELECTION IBM CARDS THAT WE STOCK

LOCAL BUS VESA CARD 1M..... $249
2 PORT SERIAL CARD..... $39
CLOCK CARD..... $29
GAMES CARD..... $19
2 WAY FDD CONT..... $89
8 BIT ETHERNET CARD..... $235
16 BIT ETHERNET CARD..... $295
PARADISE ACCELERATOR CARD. $229
CIRRUS S3 VGA CARD..... $179
2M OAK VGA 1280x1024 LocBus... $399
High Speed Dual Serial Port Card...$99

STUDENT SOFTWARE

Excel V4 for Windows..... $220
Lotus 123 V4 for Windows..... $179
Lotus Freelance V4..... $184
MS Powerpoint for Windows..... $230
MS Project for Windows..... $340
MS Publisher for Windows..... $110
MS Works for Windows..... $123
MS Word for Windows V2..... $210
Norton Back-up for Windows..... $99
Norton Desktop for Windows..... $155
On Target for Windows..... $139
Quattro Pro for Windows..... $99
Wordperfect 6.0..... $189

STUDENT ID REQUIRED WHEN ORDERING

BULK DISK PRICES

3½" DS/HD FORMATTED AND PRETESTED WITH SOFTWARE FOR DATA INTEGRITY AND RELIABILITY

ALL PRICES / BOX OF 10 - WITH LIFETIME WARRANTY. COME COMPLETE WITH WRITE PROTECT AND LABLES

DESCRIPTION	1-9	10+	50+	100+	500+
5¼ DS/DD	$4.50	$4.30	$4.30	$3.95	$3.95
5¼ DS/HD	$8.50	$7.95	$7.90	$6.90	$6.90
3½ DS/DD	$8.50	$7.50	$6.95	$6.90	$6.90
3½ DS/HD	$10.50	$9.95	$9.75	$8.95	$8.50

RITRON 3 BUTTON MOUSE

WITH 3½" SOFTWARE
$24.95

FAXROLLS

210 x 11.5 x 30m
215 x 24.5 x 30m
210 x 25.4 x 30m

1-9	10+
$4.95	$3.95

JAPANESE TECHNOLOGY
TOP BRAND DISK DRIVES
1.44MB 3½" F.D.D.$79.00
1.2MB 5¼" F.D.D...$94.00
3½ CRADLE.....$9.95

12V SOLAR CAR BATTERYCHARGER

was $28.95
NOW $15.95

RITRON POWER 100

100 WATT INVERTER
12V DC TO 240V AC
GREAT FOR CAMPING, BOATING
ONLY $99.00

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LAMPS

KRYPTON GLOBES

2.4V KRYPTON GLOBE S13430 Pack of 2...$3.95

2.8V KRYPTON GLOBE S13432 Pack of 2...$3.95

3.6V KRYPTON GLOBE S13434 Pack of 2...$3.95

4.8V KRYPTON GLOBE S13436 Pack of 2...$3.95

KNIFE SWITCH

For budding young Frankensteins. These knife switches are great for kits
Demensions:
6cm x 4 cm

	1-9	10+
S13246.....	$9.95	$8.95

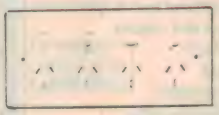
CLIPSAL 3 PIN PLUG

With safety transparent cover for instant visual safety check for connections. Recomended for 0.75mm2 and 1mm2 ordinary duty
Three core flexible cords.
250V 10A.
P18003.....$2.95

EXTENTION 75 OHM FLYLEAD

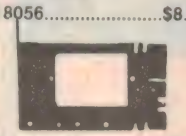
Here's how to get your TV out on the back patio or by the pool! Simply unwind the ten metre extention lead from its handy dispenser and extend your antenna to where evr you want to go.
•Length: 10 metres
• Colour: White
P32180.....$29.95

FOUR OUTLET POWER POINT



240V 10 AMP (TOTAL LOAD)
This is a real 4 outlet power point. These are greatto hard wire in. Much neater than using power boards
P18054.....$39.95

BOX MOUNTING FOR 4 WAY POWER OUTLET
Size 77mm(w) x 38mm(d) x 177mm(L)
This is ametal wall mountingbox for the above power point ideal for concrete or brick walls.
P18056.....$8.95

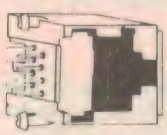


BRACKET FOR ABOVE BOX MOUNTING.
This is for in wall support of P18054 power point. ie: incavity or stud plastered walls
(comes with nails to nail into wooden studs.
P18058.....$4.95

US MOUNTING PHONE SOCKET

4 PIN SLOT PCB MOUNTING US PHONE SOCKET
• 4 slot, 4 pin wired
• Small sized

	1-9	10+
Y16008...	$2.95	$2.65



8 PIN SLOT PCB MOUNTING US PHONE SOCKET
• 8 slot, 8 pin wired
• Medium sized

	1-9	10+
Y16047..	$4.45	$3.95

KEYBOARD EXTENTION LEADS

5 DIN female plug - 5 PIN Male 1.8 metre lead Curly
P19038.....$9.95

5 DIN female plug - 5 PIN Male 1.8 metre lead Straight
P19043.....$9.95

HEAVY DUTY SPEAKER GRILLES

Robust black thick metal mesh speaker grille with rubber suround. Each grille comes complete with four right angled mounting brackets, bolts and self gripping nuts designed for wooden speaker enclosures.

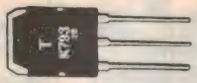
8" HEAVY DUTY SPEAKER GRILLE
C10818.....$12.95

10" HEAVY DUTY SPEAKER GRILLE
C10810.....$15.95

12" HEAVY DUTY SPEAKER GRILLE
C10808.....$19.95

15" HEAVY DUTY SPEAKER GRILLE
C10815.....$24.95

6" HORN & LINE X'FORMER
• Weather proof plastic horn with 100V line transformer
•15 watts RMS
• Adjustable metal bracket
C10218.....$74.95



POWER SUPPLY FETS FOR SVGA COLOUR MONITORS.
2SK117 / 2SK727 / 2SK793 (CAN BE ANY OF THESE AS THEY ARE ALL INTERCHANGABLE)

1-9	10+
$9.95	$7.95

NEW BNC CONNECTORS

BNC PLUG for RG59

	1-9	10+
P10449.....	$3.95	$2.95

BNC CRIMP RG59 75 ohm Male

	1-9	10+
P10450.....	$2.95	$2.45

DOUBLE BNC FEMALE

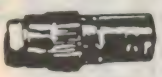
	1-9	10+
P10501.....	$9.95	$7.95

BNC JACK BNC PLUG "L" TYPE

	1-9	10+
P10526.....	$6.95	$5.95

BNC DOUBLE MALE ADAPTOR

	1-9	10+
P10525.....	$7.95	$6.50



BNC FEMALE LINE JACK SUIT RG59

	1-9	10+
P10535.....	$2.95	$2.50

ETHERNET CABLES

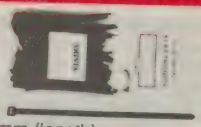
Made up and ready to use with Male to Male BNC connectors fitted.
2M 50 ohm cable.....$8.95
3M 50 ohm cable...$12.95
5M 50 ohm cable...$16.95
10M 50 ohm cable.$26.95
20M 50 ohm cable.$39.95

"TALKING ELECTRONICS" BOOKS

ELECTRONICS FOR MODEL RAILWAYS
This is the ideal book for the railway enthusiast. If you don't know too much about electronics or even if your experienced this books gives you a range of projects for you to complete. From a simple level crossing flasher that beginners can build to a project for a little microcomputer that is quite complex Not only will it drive a set of traffic lights it will automatically turn your street lights on when it gets dark .
Other projects include: Level crossing lights, economy power supply, signals tunnel stretcher and station signal delay modules, diesel sound generators. 74 pages
B10044.....$3.80

LEARNING ELECTRONICS BOOK 1.
This book on electronics starts at the beginning and covers modern electronics in an exiting way. It has been written to answer a question often asked " where do I start.?" Each chapter covers one or more components and includes a set of experiments to show how the components work. This book covers resisters. LEDs, capacitors, diodes, transistors audio amplifiers and digital electronics. 73 pages.
B10040.....$3.50

LOOK AT OUR LARGE RANGE OF CABLE TIES AND JOINERS



94mm (length) x
2.4mm (wide)
Pack of 100
Black in colour
H11402.....$3.95

200mm(length) x 4.8mm (wide)
Loop Tensile Strength:
22.2 Kg (min)
White in colour
Quantity 100
H11406.....$9.95

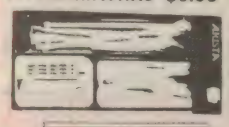
200mm (length) x 4.8mm (wide)
Loop tensile strength:
22.2 Kg (min)
Black in colour
Quantity 100
H11407.....$9.95

102mm (length) x 2.5mm (wide)
Black in colour
Quantity 100
H11410.....$4.95

102mm (length) x 2.5mm (wide)
Pack of 100
H11411.....$4.95

(95mm) • 25 Pack
H11400.....$2.95
• 100 Pack
H11401.....$4.95
• 1000 Pack
H11405.....$34.80

•140MM Lenth
x 3.6mm Width Pack of 100
H11403...Black $6.95
H11404...White $6.95



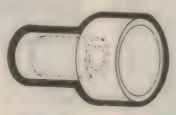
ASSORTED CABLE TIE KIT

Kit complete with three different sized nylon self locking cable ties. Ideal for the hobbyist, electrician or serviceman.
• Self hanging transparent clam shell blister for display and storage.
• 25 pieces of each of the following
• 66mm x 3mm wide.
• 122mm x 5mm wide.
• 192mm x 5mm wide
• Colour White
H11412.....$9.95

CABLE TIE BASES

Self adhesive square bases for securing cable ties
Colour White.
•22mm x 22mm, holds up to 5mm wide ties
Pack of 10.
H11390.....$4.95
100 Pcs Box
H11391.....$29.95

Self adhesive square bases for securing cable ties
Colour White.
•28mm x 28mm, holds up to 5mm wide ties
Pack of 10.
H11392.....$5.95
100 Pcs Box
H11393.....$44.95



NYLON CRIMP JOINERS

For joining wires and cables together.
• 12 amp, Size: 0.5-1.5mm, Gauge: 22-16
Pack of 100
H11394.....$15.95

• 20 amp/ Size: 1.5-2.5mm, Gauge: 16-14
Pack of 100
H11395.....$15.95

• 50 amp, Size: 2.5-6.0mm Gauge: 12-10
Pack of 100
H11396.....$16.95

SAVE ON DC POWER SOCKETS

Nut mounting. These DC Power Sockets have switching circuits and are secured with a nut.
2.1mm dia. contact pin.
1-9 10+
P12225.....$2.25 $1.95
2.5mm dia. contact pin
1-9 10+
P12226.....$2.25 $1.95

NEW BOOKS

COMPLETE IDIOT'S GUIDE

For people with better things to do!

The complete idiot's guide series delivers information that evryday users need and want to know, not everything there is to know. The authors personal writing style and *"we're all in this together"* attitude take the edge off a new technology.
Information is presented in short, magazine-like sections, which make it easy to skim and find information. Humorous asides, an open design, and cartoon illustrations provide a friendly learning atmosphere. Real-life examples and ideas for practicle applications show readers what they can do with a computer, not just how to make the parts work.
SPECIAL FEATURES:
• *"What's wrong with this Picture"* illustrations that show PC pitfalls.
• *"Opps"* tips that tell readers how to avoid and get out of trouble spots, interesting side notes that satisfy the readers curiosity.
• *"Speak like a geek"* glossary, cross-referenced index, and a convienient four-colour, tear out reference card.

Complete Idiot's Guide to Computer Terms
Beginning/Intermediate
B24110.....$18.95

Complete Idiot's Guide to WordPerfect for Windows
Beginning/intermediate
B24112.....$18.95

Complete Idiot's Pocket Guide to WordPerfect 6
Beginning/Intermediate
B24212.....$12.95

OTHER NEW BOOKS...

ABSOLUTE BEGINNERS GUIDE TO Q BASIC
B21289.....$39.95

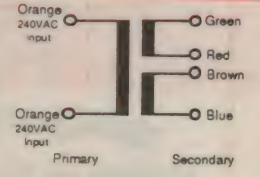
WORDPERFECT WINDOWS HOT TIPS
B21309.....$26.95

FIRST BOOK OF MS WORKS FOR WINDOWS
B22023.....$34.95

WORDPERFECT 6 FOR WINDOWS QUICK REFERENCE
B24316.....$19.95

WE HAVE OVER 60 TITLES AVAILABLE

TORIDAL TRANSFORMERS



THE ADVANTAGES OF A TOROIDAL TRANSFORMER

The size. A Toroidal transformer is small in both size and weight which allows you to meet modern requirements. They suit today's compact equipment because of their low electrically induced noise.
It combines the advantage of being small size whilst giving high efficiency allowing a conservative rating. It is also very easy to mount. All of these advantages combined make the Toroidal Transformer the best choice in the industry.
• Can be used two ways:
• Both secondary winding in series - higher volts
• both secondary winding in parallel - higher amps

160VA TOROIDS

		Mode A	Mode B
M16700	12V/24V	6.66 amps	120V 13.33 amps
M16710	18V/36V	4.44 amps	18V 8.88 amps
M16720	25V / 50V	3.2 amps	25V 6.4 amps
M16730	30V/60V	2.66 amps	30V 5.33 amps
M16740	35V/70V	2.28 amps	35V 4.57 amps

Size: 110 O/D x 50 I/D x 40 (H)mm.....**$63.95**

300VA TOROIDS

		Mode A	Mode B
M16750	12V/24V	12.5 amps	12V 25.0 amps
M16760	18V/36V	8.33amps	36V 16.66 amps
M16770	25V/50V	6.0amps	50V 12.0 amps
M16780	30V/60V	5.0 amps	60V 10.0 amps
M16790	35V/70V	4.28 amps	70V 8.57 amps
M16800	40V/80V	3.75 amps	80V 7.5 amps
M16810	45V/90V	3.33 amps	90V 6.66 amps

Size: 125 O/D x 54 I/D x 55 (H)mm.....**$72.95**

IMPROVED DECODER FOR ACS SIGNALS KIT

PICK UP HIDDEN RADIO BROADCASTS!

As many of you may well be aware, many Australian FM broadcasters are radiating either one of two "piggyback" ACS (Ancillary Communication Services) subcarrier signals inaddition to their own main programme. To listen to these "hidden signals" all you need to do is fit your FM receiver with an ACS decoder. Be able to hear such things as background music used in shopping centres, supermarkets, offices etc. Some organizations use the ACS system to broadcast programs such as news and special intrest/foreign language material. These can also be picked up on radios fitted with ACS decoders. EA SEPT. '93.....**$18.95**

ALUMINIUM SHEET
GREAT FOR KITS

Use this blank aluminium sheet for making front panels making small boxes etc. 18 gauge,
300mm x 300mm **H10780.....$7.95**

NOVEMBER SALE NOW ON

EXCESS STOCK CLEARANCE OF WIRE & CABLE

All prices per 100m roll.

SINGLE CORE MINITURE SHIELDED

Conductor: 1 x 10 strands / 0.8
Shielded: Wrapped copper
Sheath: PVC O.D. 1.3mm

Cat No	R.R.P.	Special price
W11210	~~$30.00~~	$22.00

100m Roll Save $8.00 a roll

LIGHT DUTY 75 OHM COAX

For frequencies under 400MHz

Works fine for T.V. (3C 2V)
Attenuation: 6.2dB / 100ft
Conductor: Copper 0.5mm
Dielectric: Foam P.E.
Shielded: Braided copper
Sheath: O.D. 5.8mm

Cat No	R.R.P.	Special price
W11222	~~$50.00~~	$29.00

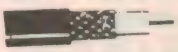
100m Roll Save $21.00 a roll

75 OHM AIR SPACED COAX CABLE

Attenuation: 4.3dB / 100ft
Conductor: Copper 1.0mm
Dielectric: Foam P.E.
Shielded: Braided copper
Sheath: O.D. 6.5mm

Cat No	R.R.P.	Special price
W11223	~~$90.00~~	$59.00

100M Roll Save $31.00 a roll



HEAVY DUTY 75 OHM COAX

Must be used for long runs & SBS / UHF TV reception ie for frequencies over 400 MHz (5C 2V)

Attenuation: 3.9dB / 100ft
Conductor: Copper 0.8mm
Dielectric: Foam P.E.
Shielded: Braided copper
Sheath: O.D. 7.5mm

Cat No	R.R.P.	Special price
W11224	~~$75.00~~	$59.00

100M Roll Save $16.00 a roll

HEAVY DUTY 75 OHM COAX

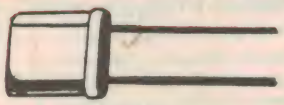
Attenuation: 3.9dB / 100ft
Conductor: Copper 0.65mm
Dielectric: Airspaced P.E.
Shielded: Braided copper
Sheath: O.D. 6.05mm
Colour: Black
Model No: RG62

Cat No	R.R.P.	Special price
W11241	~~$99.00~~	$49.00

100M Roll Save $50.00 a roll

These cables are very heavy & should be picked up from our stores. Extra Pack & Post will be charged to send them mail order.

CRYSTAL SPECIALS



GRAB SOME CRYSTALS FOR YOUR TOOLBOX

		1 - 9	10 +
2.304	MHz	$1.00	$0.75
2.764800	MHz	$1.00	$0.75
3.932160	MHz	$1.00	$0.75
4.433618	MHz	$1.00	$0.75
4.4400	MHz	$1.00	$0.75
4.750	MHz	$1.00	$0.75
4.9562	MHz	$1.00	$0.75
5.000	MHz	$1.00	$0.75
5.068	MHz	$1.00	$0.75
8.867238	MHz	$1.00	$0.75
10.00	MHz	$1.00	$0.75
10.6445	MHz	$1.00	$0.75
14.31818	MHz	$1.00	$0.75
18.0000	MHz	$1.00	$0.75
20.000	MHz	$1.00	$0.75
27.000	MHz	$1.00	$0.75
32.000	MHz	$1.00	$0.75

U - SYNC BUFFER

Provides ten signal outputs with only one P.C. system
*Utility for analog signal input.
*Highly recomended for exehibition and demonstration purposes.
*Minimum video response of 120MHz at 3dB
Display capabilities: 1024 x 768 - 1280 x 1024 resolution
Video Input: Analog (0.7Vp-p)
Frequency band-width:120 MHz at-3dB
Single connector: 9 - 15 pin D - sub connector for analog signals

5 ONLY! just $595.00 each

NOVEMBER SALE

15% off all kits
20% of all plugs & sockets
Stock Up Now!

FANS FANS FANS

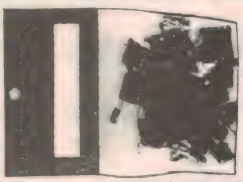
WE HAVE TOO MANY OF THESE

115V 3.5" (88.9mm) 1 - 9 10 +
T12467 $7.50 $6.00

240V 3.5" (88.9mm) 1 - 9 10 +
T12465 $14.50 $12.95

12V (80mm) PLASTIC FAN COMPUTER POWER SUPPLY

1 - 9 10 +
T12462 $10.50 $9.00



$10.00 GRAB BAGS

These grab bags contain a range of components and parts from old kits, including wire and LED's ceramic trimpots from the Service Dept. and old IC's, odd fuses crystals and tantalums.

$20.00 MONSTER BAG

Same components as listed above but heaps more and more value.

RODS VALUES PACKS

ASSORTED VALUE PACKS

• .25W 1% METAL FILM PACK
• Contains: Approx. 250
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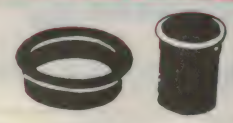

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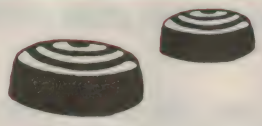

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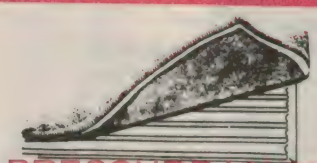

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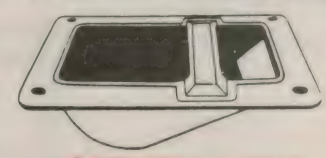

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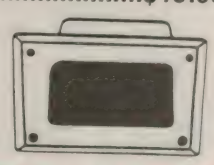

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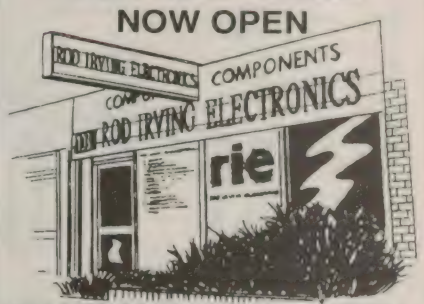

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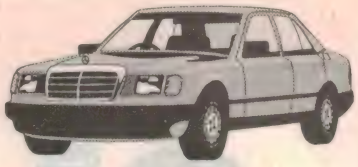


with MAJOR AL YOUNGER (USAR, Ret.)

Toyota's 'Air Flow Control' (AFC) system

Toyota's AFC engine control system has many variants, depending upon the model number, the engine type and the country it's sold in. There are significant differences from country to country, because of the pollution control devices required by law — and also the availability of lead-free petrol. To find out which version you have, you need to check the identification plate under the bonnet, for the care model and engine type.

Readers have been sending me queries on Toyota systems, but often don't supply complete engine identification — for instance the 3S engine has several variations. There's a 3S-F, a 3S-FE and a 3S-GE, with variations in each. It's important to clarify the exact version you have, since different engines have different ECU's and codes.

Also, Toyota is well known for changing systems in the middle of a production year. So make sure you find out *exactly* which version you have. This will save you embarrassment when ordering parts. The parts suppliers go by the numbers (or letters).

Look on the firewall for the identification plate. It lists all the data required, like model, engine code, manufacturing date and more. If it's a 'full production model', i.e., imported from Japan, make sure you state this. (Yes, they're all different — even the New Zealand models are different. If you purchased one in the UK and brought it here, it's different too.)

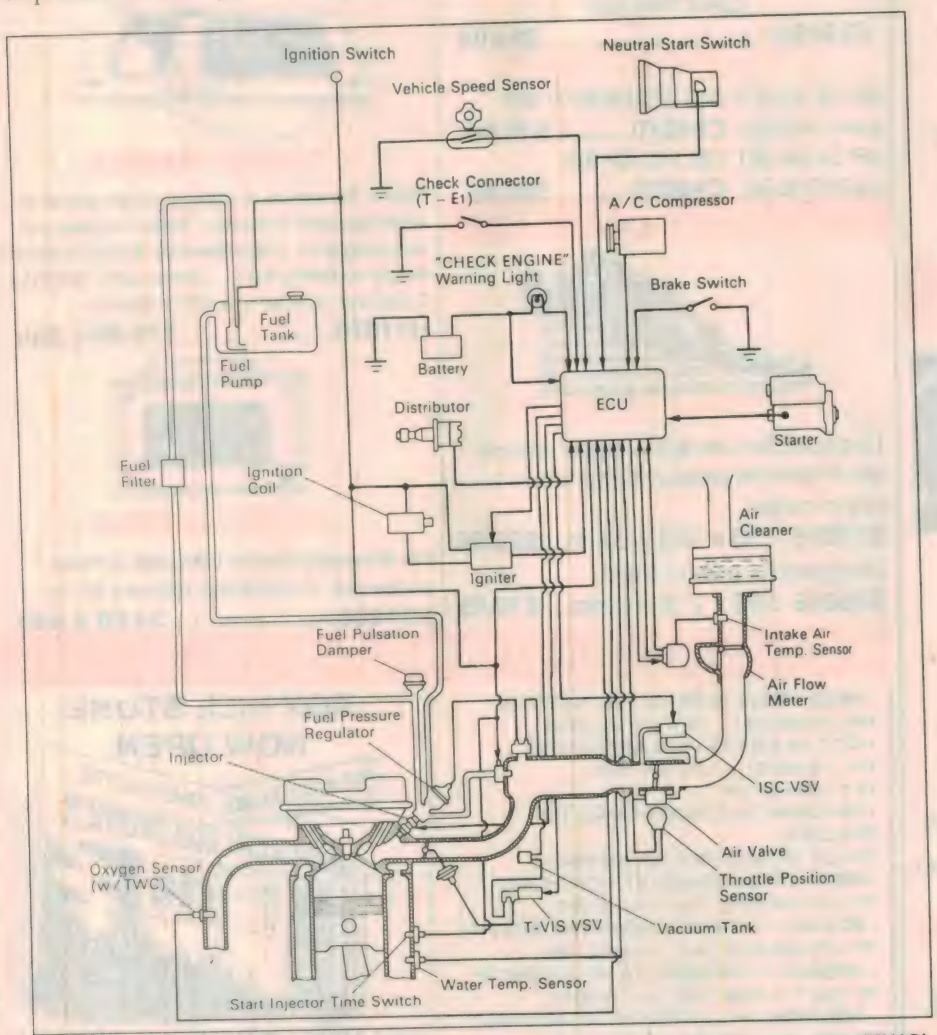


Fig.1: A full-blown Toyota TCCS system with three-way catalytic converter (TWC).

Fig.1 shows a full blown Toyota TCCS (FE-GE) system with TWC (three-way catalytic) converter. The basic operations are the same on all systems — this one's just more sophisticated for high performance and pollution control.

The fuel injection system is an electronically controlled system operated by the incoming air flow — hence the term 'air flow control' or AFC. Systems fitted with a TWC converter provide a feedback loop from the oxygen sensor, to reduce pollution by controlling the AFR (air fuel ratio) at the optimum stoichiometric ratio of 14.7:1.

Fuel control

AFC systems have a basic injection quantity (BIQ) to provide fuel for the engine. This is the time of fuel injector opening in milliseconds. The BIQ is determined by the engine parameters (bore, stroke, etc.,) and the volumetric efficiency of the engine. It corresponds to the minimum amount of fuel required to keep the engine running.

The BIQ range is from 2.0 to 3.75 milliseconds of injector opening (duration). It's only modified by operating conditions. In addition, the ECU is programmed to add or subtract from the BIQ, depending on fuel demand for a particular operating condition. For in-

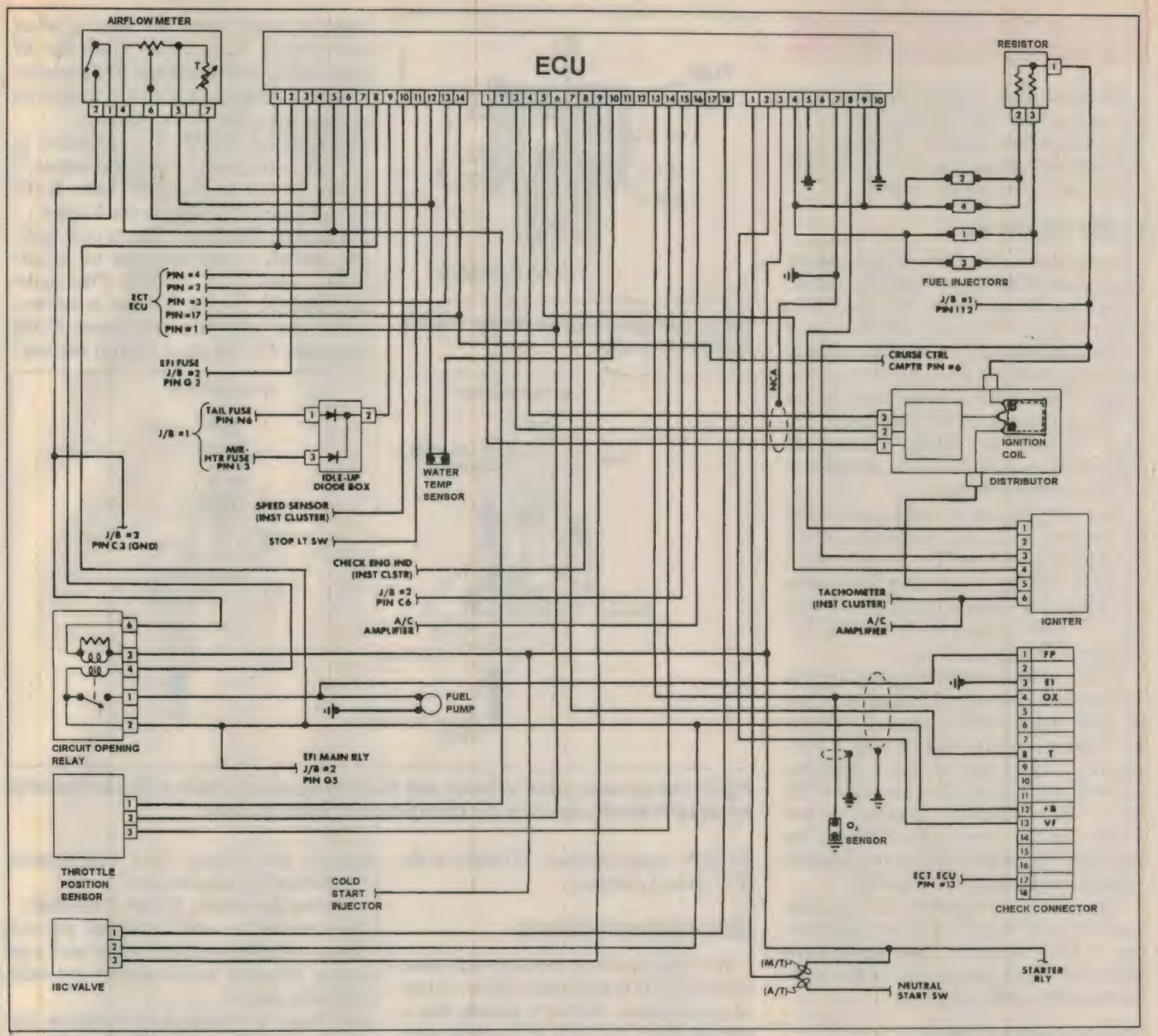


Fig.2: The electrical schematic for the Toyota ECCS. The airflow meter (AFM) is shown at upper left.

stance, for a normal cold start, the ECU provides a starting enrichment by expanding the IPW (injector pulse width) from 3.75 to about 18 milliseconds.

Now don't get a 'normal cold start' — i.e., starting a cold engine — mixed up with the function of the 'cold-start injector'. Unless you live in the 'Snowies', the latter circuit is *never* likely to be energised by the ECU. Likewise, if you live in Burketown, don't let anyone tell you your 'cold start circuit' is not working and should be replaced.

Operation

The amount of incoming air is a function of the throttle valve opening (i.e., pressing the accelerator pedal). This is monitored by the air flow meter (AFM), as is the ambient air temperature (See Fig.2). The air temperature is used to calculate air density.

The AFM's vane is moved by the incoming air, and is attached to a potentiometer wiper which outputs a varying DC signal to the ECU. The ECU then increases the IPW (more fuel) to control the AFR. (Remember that the main purpose of the ECU is to control the AFR.) It accomplishes this by controlling the injector pulse width (IPW). To do this it must also monitor or control the ignition system — i.e., spark timing.

The name of the game is *electronic fuel injection*, and only an ECU can do the job with the required accuracy. Oh yes — along the way, it controls emission and pollution. I always think of the latter last, because if the engine's not in good nick, you can forget about pollution control.

Two types of ECU

There are basically two types of electronic control unit (ECU) in use, depending upon the year of manufacture. The early ECU is designated as EFI (electronic fuel injection). It's a barebones minimum system, with no TWC converter, and has only seven codes for diagnostics. The ECU used in later and current systems is the TCCS (Toyota computer control system). This also has several variations, dependent on the engine and whether its fitted with a TWC. TCCS systems will have from 11 to 13 diagnostic codes.

Vehicles fitted with the Holden 3800 V6 engine use the GM/Holden ECU. This system uses Density (or MAP) control, not AFC. Note that the Toyota 1S-E engine also uses density control.

Code retrieval

For models with a CEL (Check engine lamp), just bridge pins T and E1 on the test connector to retrieve the diagnostic codes (Fig.3). The CEL will blink out the numerical codes. A no-fault (normal) will blink the lamp ON and OFF continuously. There are too many codes to list in this article (it takes four pages). A code booklet is available listing all Toyota vehicles sold here — see the end of this article for details.

You can also test the operation of the O_2 sensor at the test connector. To do this bridge pins T and E1, set the engine speed at 2500rpm for at least 90 seconds and place your analog multimeter (set to the 15V DC range) leads to pins VF (feedback voltage) and E1.

If the system is operating correctly, the voltmeter needle should fluctuate eight or more times in 10 seconds. If it's too slow (low counts) short the water temperature sensor, for 'not more than one minute' at 2500rpm. This leans the AFR, raises the combustion temperature and cleans the O_2 sensor. (**CAUTION: do not short the sensor for more than one minute, or damage may result!**)

You can also monitor the ignition (tacho) pulse, battery and fuel pump status at this connector. **But make sure that you don't short any of the connections to earth (chassis).**

Troubleshooting

I have never relied upon codes for diagnosing a Toyota AFC system. I use what some call 'the BIQ method'. All that's required is an injector pulse width (IPW) tester and of course a DMM.

My IPW tester holds the high and low readings on recall. I hook up the input lead to any injector. On a cold start I will see the IPW increase, during cranking, then drop to a point determined by the water temperature sensor. As the engine warms to operating temperature, the IPW should move into the range from 2.0 to 3.75 milliseconds. If it's on the high end (3.75ms), the engine is running slightly rich.

If the IPW is not within specs, I know I have a problem. With the IPW tester I can check every sensor circuit that affects IPW calculations. For instance, if I disconnect the water temperature sensor, the IPW should increase. If I short it, the IPW should decrease.

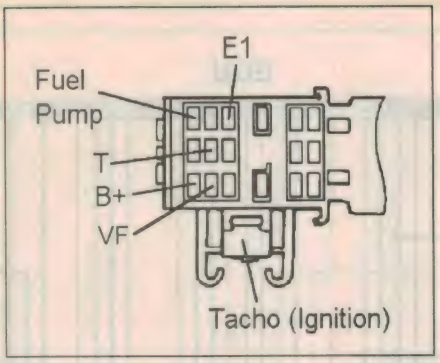


Fig.3: The connections to the Toyota TCCS test socket.

Common problems

The most common problem with these systems, as it is with most others, is lack of maintenance. But let's assume this is not the case, and look at the *next* most common Toyota problems and their likely causes:

HARD STARTING: The most likely cause is the air valve not opening when cold (Fig.4). To test this, pinch the air hose during cold cranking. Then release it when the engine starts — if there's no change, the valve is not opening.

HIGH IDLE RPM: The air valve is probably not closing when the engine is warm. To test it, pinch the hose. If the rpm changes, the valve is stuck open.

ERRATIC IDLING: The throttle position switch is probably out of adjustment — see Fig.5. (NOTE: First make sure that the throttle linkage is correct. If it's too tight, this will cause idling problems. On the other hand if the linkage is too loose, this may cause 'hesitation' on acceleration).

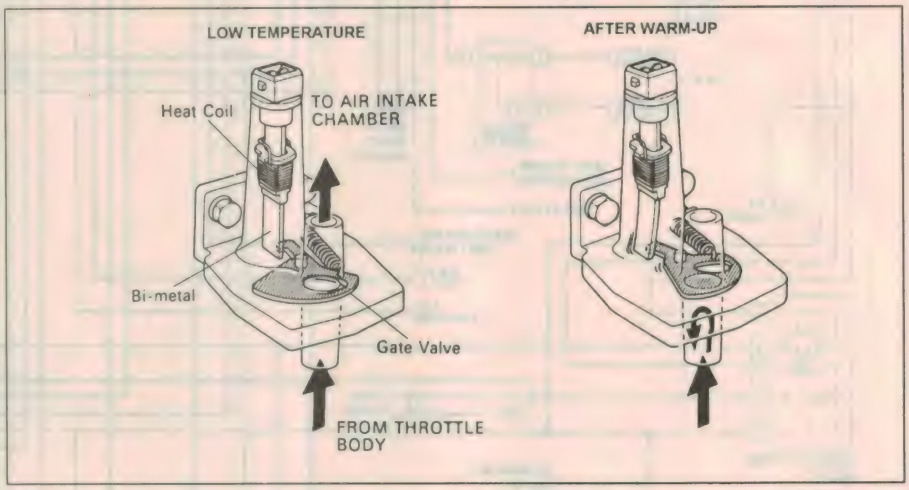


Fig.4: The air valve uses a heater coil to warm up a bi-metallic strip. As the strip heats up it bends, causing the spring-loaded valve to close.

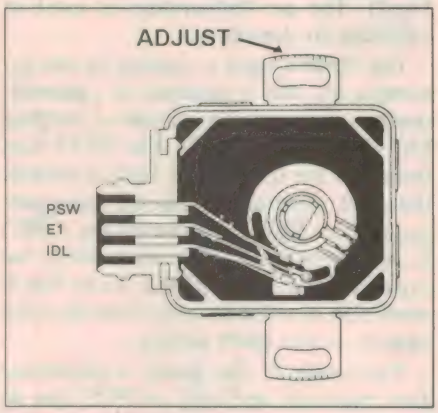


Fig.5: The throttle position switch is adjusted by loosening its mounting bolts and rotating the body.

To test the switch, follow these steps:

(a) Remove the connector and place a 50mm shim between the lever and stop screw. Measure for continuity between pins IDL and E1.

(b) Place a 90mm shim between the lever and stop screw. Measure for no continuity between pins IDL and E1.

(c) Move the throttle to 75% or greater. Measure for continuity between PSW and E1.

If the above tests fail, loosen the mounting bolts and adjust the switch. If it cannot be adjusted, the switch is faulty. The switch is sealed, but a good technician can take it apart and fix it. I have fixed many.

AIR LEAKS: Leaks in front of the AFM (Fig.6) allow hot air (from under the bonnet) to enter the system. The air temp sensor then leans the AFR and the engine may stumble or backfire. If air leaks occur between the AFM and the throttle body, the effect is the same: a lean AFR (too much air). This 'un-metered air' cannot be controlled by the ECU, and can again cause engine stumble or backfire.

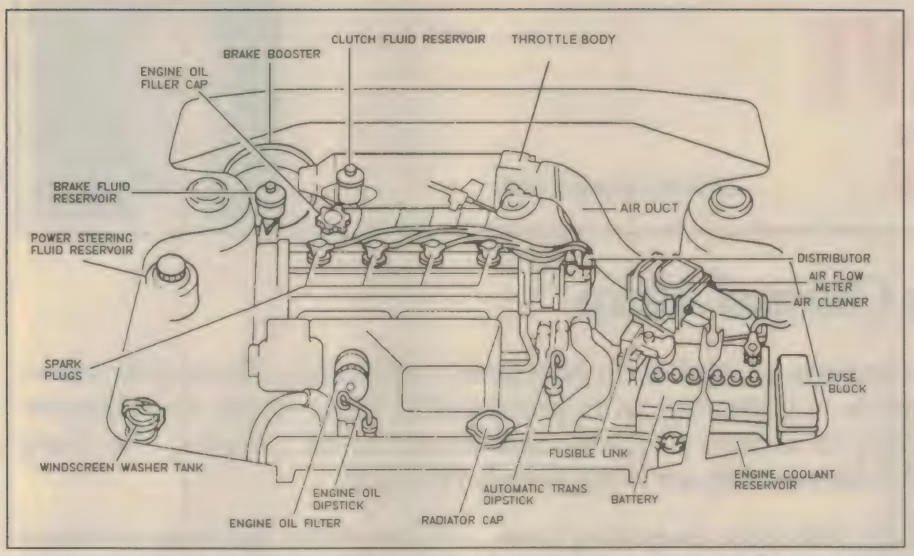


Fig.6: A general view under the bonnet of a typical Toyota, showing the location of some of the main components discussed in this article.

Incidentally, an engine backfiring may *destroy* the AFM and any other device fitted to the vacuum system.

VACUUM LEAKS: Gasket leaks can occur on the throttle body and intake manifold. At hot idle, try spraying the gasket areas with an electrical cleaner. If the engine increases its idling rpm, there's a leak. (NOTE: Do not use other harsh cleaners like brake cleaner. It may 'eat up' the wiring.)

IDLING PROBLEMS: Cars with electronic engine control systems are plagued with poor or erratic idle. Why? Because just about everything effects idle. Most often, it's something simple and not of an electronic nature.

Here's the scenario: the idle is not correct and some clown re-adjusts the base idle system. WRONG! I've seen trained technician make this mistake. The facts are that base idle does NOT require adjustment unless a part that affects idle has been replaced. A simple short or open circuit may effect idle and quite often does.

Keep it running

If your engine acts up, it's telling you something's wrong. Jump on the problem and fix it immediately.

I made a 1500 kilometre trip with no problems. The day after returning, the engine took a long time cranking to start. I shut it down, opened the bonnet and removed the air filter. It was all full of bugs and trash. I vacuumed it clean, put it back in and started the engine up. End of problem!

Just remember that electronic fuel injected cars should start *very easily*, under all conditions. That's the way 'Detroit' designed them. So if you have starting problems, something is wrong.

One thing I love about electronic cars: if something is wrong, it will tell you, by acting up. Fix it sooner — if you leave it until later, it will very likely eat a hole in your wallet!

Equipment you need

I have received many letters from readers asking about equipment they can build to diagnose electronic vehicles. Well, it's in the mill now. I'll even get into what's required to use a PC.

Incidentally, I still receive requests for internal data on the ECU's, such as schematics, parts lists and sources of ICs, etc. Don't waste your time — it's simply not available, unless someone has generated it on their own.

If you're serious about fixing ECU's, make a tester first — since 75% of all ECU's diagnosed 'bad' are good.

Just sourcing the connectors required for a tester is an expensive and time consuming exercise. Collect a bunch of faulty ECU's and use them for spare parts. If a processor chip is shot, it's junk, since it cannot be sourced (most are proprietary).

Most often, the driver chips are smoked; some of these can be sourced. Lots of luck — the market is there.

By the way, my booklets *Maintaining the Electronic Motorcar* ($25), *The Code Book* ($35) and the *Ford EEC-IV* ($60) have all been expanded or updated. If you want any of these, send a cheque to Major Al Younger, PO Box 477, Double Bay 2028. These prices include postage, for New Zealand as well as Australia. ❖

SHORTWAVE LISTENING

by Arthur Cushen, MBE

Many broadcasts from Channel Africa

South Africa is scheduled to have elections on April 27th next year, and already Channel Africa — formerly known as Radio South Africa — is gearing up to promote the views of the new Government throughout the continent. With its change of name, and emphasis on covering the many countries in Africa, broadcasts from Johannesburg are being widely received.

Broadcasting in South Africa started on December 29, 1923 under the somewhat unlikely control of the South Africa Railways. The three stations which had been established were incorporated into the African Broadcasting Company in 1927. Later, the South African Broadcasting Corporation was established, and it operated stations on mediumwave and relays of the programmes on shortwave.

By 1949, several 5000W transmitters were operating at Johannesburg, Durban, Capetown and Peitersmaritzburg. Then followed the establishment of a shortwave service at Paradys near Bloemfontein, with nine 20kW transmitters. And so South Africa continued to serve its internal audience until 1966.

Radio RSA, the SABC's shortwave external service, was established in 1966 and had soon reached almost every corner of the world. The station's multi-lingual programmes had been made possible by the building of the H.F. Verwoerd Transmitting Station at Bloemendal near Johannesburg.

The writer visited the transmitting site and monitoring services of the SABC in 1969, and the broadcasts in those days operated out of studios in Commissioner Street.

Earlier, RSA was broadcasting a daily transmission to Australia and New Zealand, but due to the propagation problems over the polar path, this was not a success. Hence the transmissions to this area were terminated, and RSA focused its broadcasting on Africa, Europe, and North and South America.

In 1976, new studios at Auckland Park were opened by SABC, covering the radio and television services as well as Radio South Africa. Broadcasting Centre, standing on 15 hectares to the west of Johannesburg's city centre skyline, is one of the largest complexes of its kind in the world. Comprising a 36-storey administrative tower, several floors of radio studios in an adjoining block and a separate television building, it is owned and operated by the South African Broadcasting Corporation.

The SABC shortwave service, known as Radio RSA, was changed on 30 April 1990 to Channel Africa. The change is in name only, as the facilities and all their services remain as before. Channel Africa now broadcasts in seven languages, reaching millions of listeners in most African countries. The languages are English, French, Portuguese, Lozi, Swahili, Tsonga and Chichewa. Channel Africa is the only African broadcaster providing a daily radio service to the entire continent.

The new transmitting site now houses several 250 and 500kW transmitters, and there are some 58 aerials.

The headquarters of Channel Africa are located in these studios at Auckland Park near Johannesburg, which was opened in 1976.

Changes at Guam

The two broadcasting stations on Guam have undergone some changes. KTWR now has a new schedule in English with three transmissions: 0745 - 0915 on 15,200kHz; 0830 - 1000 on 11,805kHz; and 1445 - 1700 on 15,610kHz. KTWR has four 100kW transmitters and broadcasts the programmes of Trans World Radio. Plans are underway to install another 100kW transmitter, according to Adrian Peterson who visited Guam recently.

KTWR opened on September 24, 1977 and at that time had two 100kW Harris transmitters, with its first operating frequency being 15,155kHz. It ran a special DX programme during the 1980's up to 1990, which was conducted by Bill Dimmick who later moved to TWR Swaziland.

KSDA, operated by Adventists World Radio, is to install another 100kW transmitter. This will join the current two 100kW transmitters which were put into service when the station opened on March 6, 1987. The station broadcasts in 18 languages using nine frequencies, and English is heard at 0100 on 15,610kHz and at 0200 on 13,720kHz (the latter on Saturday/Sunday only).

AWR is at the present time negotiating with a West African country for the installation and operation of a gospel station, but the location and plans have not yet been announced. In the meantime,

the AWR broadcasts over Africa Number One at Gabon have ceased, and the hiring of one hour daily on the Gabon transmitter also recently came to an end. This transmission time has now been transferred to a station in Russia. AWR now has an address on the African continent of PO Box 1751, Abidjan 08, Cote D'Ivoire (the Ivory Coast).

Stronger Italian radio

Broadcasts from Rome Radio RAI are being received at improved strength, and its familiar mechanical nightingale sound is heard more often across the shortwave bands. This follows the construction of an impressive new radio and television centre in Rome, which houses all facilities including the shortwave services.

The complex is housed in nine buildings with a total area of 275,000 square metres, 15 television studios, 35 radio studios, and 55 radio and TV dubbing points. The enormous complex also contains banks, a medical centre, cafeterias, snack bars, a chapel for religious functions, a fire fighting centre, and security forces which include the National Police.

The Centre may well be the most modern structure of its kind in Europe, and is certainly one of the world's largest. It uses enough electricity to light an entire district of Rome, and its own generators produce 6400kW. Its 19 parabolic antennas, four of them extremely large and motor driven for continuous orientation, permit radio and television reception and transmission via satellite.

The shortwave section moved to the new radio centre in March 1993, including translators and announcers of foreign language broadcasts. Rome sends out broadcasts in 26 languages on shortwave, and technical quality is being improved with a proposal to strengthen the antenna systems. The Centre has plans to lease time on other international broadcasters, because the present transmitting site at Santa Palmoba near Rome has no room for further expansion. A new broadcasting centre may be built in Tuscany in the near future to extend shortwave transmissions.

AROUND THE WORLD

This item was contributed by Arthur Cushen, 212 Earn St. Invercargill, New Zealand who would be pleased to supply additional information on medium and shortwave listening. All times are quoted in UTC (GMT) which is 11 hours behind Australian Eastern Daylight Time and 13 hours behind NZ Daylight Time.

KIRIBATI: Broadcasting from Tarawa in the Central Pacific, Kiribati has recently been heard on the new frequency of 9825kHz, replacing 17,440. This low powered 500W transmitter is received at 0600 after the BBC Arabic Service leaves 9825kHz. Kiribati opens with a relay of the BBC World News, and at 0609 there are six minutes of local news in English followed by a musical programme. Scheduled sign-off time is 0830, but since moving to this new frequency, the transmissions have been noted to past 0900.

KOREA: Radio Korea, Seoul recently celebrated 40 years of broadcasting. The station commenced operation after the Korean War in 1953, with an English programme on mediumwave. It was then known as the Voice of Free Korea. In December 1955 the Japanese Service was commenced, followed by broadcasts in Korean, then Chinese and in 1963 Spanish. By 1985, Arabic, Portuguese and Italian had been added to the schedule.

The Olympics in Seoul resulted in the introduction of satellite transmittions, and today Radio Korea is relayed by Radio Canada International and the BBC, through its transmitters at Skelton. Radio Korea lists its English language service as its most important overseas transmission. Seoul is heard in many transmissions, and one relayed through Radio Canada International at 1030 on 11,715kHz provides the best signal. On Sunday, this outlet includes a programme 'Shortwave Feedback' for DX listeners.

SLOVAKIA: Radio Slovak International has been heard at 1830 on 7345kHz announcing the following schedule: "Our English language broadcasts are heard every day including weekends at 1830 on 5915, 7345 and 9605kHz." The broadcast is repeated to North America at 0100 on 5930, 7310 and 9810kHz, and to Australia at 0830 on 9990, 15,615, 17,535 and 21,705kHz. According to a verification letter from Mr Richard Guga, Director of English Broadcasting, Radio Slovakia International has transmitter sites at Rimavska Soboto and Velke Kostalany, located in South Central Slovakia. The vertification letter was accompanied by a new sticker showing the slogan, flag and map of the country. The address for reception reports is: Radio Slovakia International, Mytna 1, 812 90 Bratislava, Slovakia.

UNITED STATES: Broadcasting from Tampa, Florida WFLA, using the high frequency of 25,870kHz, was reported some months ago. WFLA is an AM station on 970kHz which I first heard in 1945. In the verification letter for 25,870kHz, the present Chief Engineer reflected on the station's history. It's new high frequency transmitter has a power of 100W, is assigned the call KPM-360, and is used for communication with two traffic aeroplanes and Metro Traffic. The transmitter is narrowband FM, and reports have come in from listeners in most European countries, the USA, Canada and South America, as well as the Pacific. Reception should be again possible during our summer around 0100. As well as verifying with a personal letter, the station card and coverage map was also included. Reports should be sent to Wilson Welch, Chief Engineer WFLA, PO Box 130097, Tampa, Florida 33681-0097, USA.

Rome Radio broadcasts in English to this area of the globe at 2200 - 2225 on 9710, 11,800 and 15,330kHz. Other broadcasts are at 1935 - 1955 on 7275, 9710 and 11,800kHz; and 2025 - 2045 on 7235, 9575 and 11,800kHz, which are beamed to the Near East. A service to North America at 0100 - 0120 uses 9575 and 11,800kHz, and to North Africa at 0415 - 0440 on 7275 and 9575kHz. The address of RAI Rome Radio is Casella Postale 320, Correspondence Centre, 00100 Rome, Italy.

History of shortwave

Recently Radio Japan presented a special feature looking back at the history of shortwave broadcasting and the role it has played in world affairs. Japan itself commenced a shortwave service in 1935.

In 1927 Philips Radio at Eindhoven, Holland had begun broadcasting with station PCJ, the forerunner of International shortwave services. PCJ was later taken over by the Dutch State Broadcasting and became Radio Nederland after World War II.

In 1932, the historic broadcast of the Christmas message by King George V is well remembered by the writer as one of the earliest broadcasts. Following the commencement of operation by the BBC General Overseas Service, Russia, Germany and France also commenced a shortwave service, realising that shortwave was a part of military strategy right from the beginning.

The world situation was tense in the 1930's and 40's. The fierce competition between Great Powers culminated in the Second World War. Every country boosted the broadcasting time of its shortwave stations and expanded the power output of the transmitters. This was also the time when relay broadcasts first entered practical operation. It is sad to note that the greatest periods of growth in shortwave broadcasting have all been related to military conflict.

In 1948, with the start of the Cold War, Stalin began to 'jam' transmissions of the VA and the BBC directed at the Soviet Union and Eastern Europe. Jamming from the Soviet Union and Eastern Europe did not stop entirely until the end of 1988. The main jammers are now located in the Middle East, Korea and China, according to the report from Radio Japan. ❖

JAYCAR DEALS FOR NOVEMBER

VIDEO AND CAMCORDER ACCESSORIES

VIDEO PROCESSOR WITH ENHANCER & STEREO MIXER

This mixer will allow you to make quality home videos from your camcorder. You can add a stereo input from your stereo / CD etc, and mix it with the sound originally recorded as well as a narrative with a microphone. All this can be mixed together and recorded on your normal VCR. There is a built in video enhancer to ensure no loss of picture quality occurs as you transfer from the camcorder (VHS-C/Video-8) to your VHS home VCR.All line inputs are RCA, microphone is 3.5mm. Power supply required is 12VDC - 100mA, use MP-3006 - $15.95 and microphone use our AM-4090 - $15.95.

NEW

Size: 220(W) x 125(D) x 65(H)mm. Cat #: AV-6410 **$79.95**

VIDEO CAMERA BATTERY

This battery is a universal type that fits Sony, Panasonic, JVC, Hitachi and Canon camcorders. It is 6v, 2000mAh and it uses quality Japanese cells.

NEW

Size: 90(H) x 45(W) x 43(D)mm. Cat #:SB-2320.

Don't pay $99 Only $69.95

BATTERY ELIMINATOR

Suits Sony, Panasonic, JVC, Canon & Hitachi. This unit allows you to power your video camcorder from the cigarette lighter. This saves batteries. It has a curly cord lead about 2 metres long and reduces and regulates the voltage to 6 volts. An economical way to save your camcorders batteries.

NEW

Cat #:MP-3130. **$29.95**

TRIPOD - Large

Features: •two way pan head with quick-release plate and spring operated locking pin for camcorders •extra long stick •continuously adjustable by means of a crank with adjustable friction brake •tripod legs with vertical lever locks •cross bracing and closed channels - rubber feet •max extended height 131cm •retracted height 53cm

Cat #: AV-6535. **$59.95**

Tripod shown fully retracted

TRIPOD - Small

Table tripod. Ideal for use with our video transfer system. Extremely small when folded - about 180mm long. Height when opened 120mm. Very stable.

NEW

Cat #: AV-6532. **$18.95**

DIRECTORS BOARD

You see these used all the time in commercial movie making. It allows you to number each take, if you take more than one and also allows the camera operator to correctly focus on the board. It's even supplied with a piece of chalk on a string. Size: 280 x 255mm.

Cat. #: AV-6530

$16.95

NEW

PROFESSIONAL VIDEO PROCESSOR WITH ENHANCER / MIXER

If you require more features than our basic video processor , this may do the job. Extra features include: •two inputs for video - one camcorder and one VCR or two camcorders etc. •two switchable stereo sound inputs, one can be for CD, the other tape •twin LED VU meters •bypass switch •AV fade switch - fades in or out both audio and video simultaneously •headphone socket •stereo microphone input sockets. All inputs and outputs are RCA, microphones are 6.5mm, headphone is 3.5mm. Power supply required is 12VDC 800mA - use Cat MP-3015 $24.95

NEW

Specifications

Audio Input Sensitivity		Audio Freq Resp	20-20kHz
CD/Tape/VCR/Cam Audio	100mV	Video Output Level	1V P-P/75Ω
Microphone	1mV	Video Enhancer Range	+/- 6dB
Max Audio Output	2v	A/V Fade Time	3-5 seconds
Audio Distortion	1.5%	Power Source Required	12VDC 800mA

Cat. # AV-6415 **$139.50**

UNIVERSAL VIDEO BATTERY CAR CHARGER / DISCHARGER / POWER SUPPLY

NEW

•This universal charger will: - •Accept most camcorder batteries. These include Sony 8mm NP-22, NP-55, NP-66, NP-77 6 volt, Panasonic / JVC VHS-C 6 volt, Canon 8mm 6 volt, Olympus, Nikon, Elmo, Chinon 8mm 7.2 volt, RCA / Hitachi 8mm 6 volt and all 9.6 volt VHS and VHS-C batteries. •Discharge and charge all of the above from your car cigarette lighter or 12 volt DC source - even a 240 volt plugpack 12VDC 1000mA (use slow charge mode only) Cat MP-3015 $24.95. •Two charging times available - emergency QUICK charge in 20 minutes or NORMAL charge about 1-2 hours. •Power your 6, 7.2 or 9.6 volt camcorder from your cars power through this supply. IE: it will reduce the cars 13.8volt down. Supplied with car cigarette lighter power lead and instructions.

Cat. #: MB-3520 **$59.50**

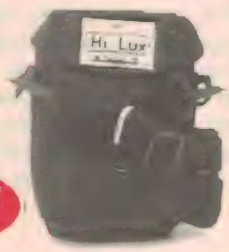
CAMCORDER WIRELESS MICROPHONE SYSTEM

With this microphone system you can be videoing someone 50 metres away and hear and record them talking as if they were standing right next to you. And it works well. It consists of • a receiver which mounts on the camcorder camera shoe and plugs into the microphone input. It is about the size of a packet of 20 cigarettes (88 x 60 25mm approx) •An earpiece is supplied so you can monitor what is being said •A transmitter which clips on the belt of the person using the microphone. The microphone is then plugged into the transmitter (which is the same size as the receiver) •Two microphones are supplied - one is a tie clasp type and the other is a small hand held type. Other features include: •two operating frequencies •up to 200 feet (66 metres) line of sight range •extremely lightweight and compact •eliminates wires from the microphone •earphone allows "live" monitoring

NEW

Both transmitter & receiver require a 9 volt 216 type battery Cat. #: AM-4065 **$129.50**

RECHARGEABLE BATTERY CARRY CASE



This case will accept a 6.5Ah gel battery. It is ideal for video camera users or for hand held 12 volt spotlights for shooters, night bush walks etc. It has leads for connecting to the battery inside the case (positive lead is fuse protected) and a cigarette lighter socket is mounted on the side. It has removable strap for hanging on the shoulder and a belt loop.

NEW

Cat #: HB-5950 **$24.95**

QUIK KIT COMPONENT CASE

Quik Kit is a very sturdy storage and carry case for components, small parts and tools etc. It has 11 compartments inside, there are 10 small ones measuring 59 x 59 x 45mm high. The large compartment will hold screwdrivers, soldering irons etc and measures 310 x 80 x 45mm high. When the lid is closed each compartment is sealed from each other and there are two slide catches to hold the lid closed. Total size is 312(W) x 220(D) x 50(H)mm. Colour is grey. Made in Australia.

NEW

Cat. #: HB-6315 **$16.95**

UNIVERSAL REMOTE CONTROL

Just about every piece of equipment you purchase today has a remote control. How many remote controls do you have lined up on your coffee table? This remote control will "Learn" the functions of most remotes so you can retire them all and use just one. It will control up to 5 devices any of which could be a TV, VCR, CD player, laser disk, cassette deck, amplifier etc. Other features include: •Backlit keyboard - all buttons light up for a short time at the touch of a button so it's easy to use in the dark. •Unique scan button for entering group commands or scanning through a sequence of commands. •Master power switch controls all devices at once. •Size: 155 x 53 x 26 mm.

Cat. #: AR-1705 **$89.95**

NEW

UNIVERSAL RUBBER HOLSTER FOR DMM'S

This quality holster suits our large digital multimeters. It will protect them from drops and general rough treatment. It includes a tilting bail and can be wall mounted. It will suit the following DMM's: TES 3.75 digit - Cat QM 1475, TES Frequency DMM-Cat QM1520, Dual Display DMM -Cat QM1525, Meters 4.5 digit DMM-Cat QM1460 plus other full size meters with height about 185mm and width approximately 85mm. Holster size: 200 x 99 x 55(D)mm.

NEW

Cat #: QM-1510

$19.95

RECHARGABLE LANTERN BATTERY

This 6 volt 5AHr rechargable sealed lead acid battery suits those ever popular Dolphin style torches. Why waste money throwing away batteries. You've seen these advertised by others for $39.95. We've got them cheaper!

Cat. #: SB-2498

ONLY $32.95

NEW

SILICON CHIP REMOTE CONTROL PREAMPLIFIER KIT

NEW

REF: SILICON CHIP SEP/OCT/NOV 1993

Jaycar Electronics is proud to announce this exciting new project from Silicon Chip magazine. Presented here is a project for any kit builder hungry for a challenge! The final result - a stereo preamplifier that incorporates the very latest in audio design technology. With over ten years of experience in presenting high performance audio kits, Jaycar has built an impressive list of projects such as the famous 8002 audio mixer, Black Monolith power amplifier, Series 5000 triad of projects, Playmaster & Studio series projects, AM/FM Digital Tuner and the list goes on. With a list this long, it's easy to see why Jaycar are the undisputed leaders in audio kit production. Our high performance audio kits are second to none. This new Remote Control Preamplifier is (of course) no exception.

The heart of this preamplifier is a Motorola microprocessor, and with only two PCB's, this kit is surprisingly straight forward to put together. An important feature is the remote controlled volume. Apart from convenience, the remote solves the problem of the volume potentiometer becoming increasingly noisy with constant use. A second problem with volume pots, is their poor tracking between channels, particularly at low volume settings. With this new Remote Preamplifier, no noise can develop because there are no moving parts in the volume control circuit, and the channel tracking and balance is excellent, even at low volume settings.

REMOTE CONTROL

Quite frankly we feel that the kit remote control simply does not do justice to the rest of the kit. It's very old fashioned looking compared to current remote controls. So, we have not included this kit remote with the main kit, but offer a pre-built unit as an extra. This has the ability to "learn" the functions of the preamp and will also control four other pieces of equipment. These could be your CD player, TV, VCR etc. So, not only do you gain another remote control, *you can retire all the others*. The remote control is pre-programmed for the preamp and has a unique backlit keyboard. All buttons light up for a short period of time at the touch of a button. If you purchase a kit and already have a learning remote, you can post it to us (including return mail costs) and we will program it for you *absolutely free!!!*

EXCLUSIVE - JAYCAR "BLUEPRINT" VERSION

Jaycar will of course be producing a standard version of this project. This version will include the fluorescent choke-type power transformer, nickel plated RCA sockets, Scotchcal panelling, carbon film resistors and standard screened cabling as well as the other parts specified in the projects part list. In addition to this, however, we will also be making available a fully Blueprinted kit which will include (but not limited to) the following features:

- •low noise radiation toroid power transformer
- •fully punched and screen printed front panel in distinctive "Blueprint" artwork
- •gold plated RCA sockets throughout
- •special low capacitance screened cabling
- •machined pin IC socket for the microprocessor
- •1% metal film resistors instead of carbon types
- • pre-programmed microprocessor *included* in the cost
- • pre-wound chokes
- • metal thread fixing screws fixing inserts clinched into chassis. Beware of cheap chassis' that use self tapping screws!!
- • specially written step-by-step instructions
- •remote control extra

PCB SECTION

STANDARD KIT

Includes all specified components except microprocessor and programming which must be obtained from Silicon Chip. No remote control.

Cat. #: KC-5140 **$419.00**

BLUEPRINT KIT

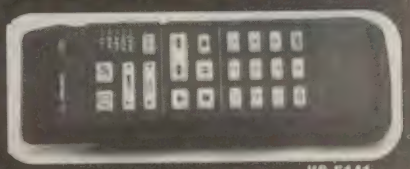
Kit as described including all the additional "Blueprint" features, including the pre-programmed microprocessor and without any remote control.

Cat. # KC-5142 **$489.00**

PRE-PROGRAMMED REMOTE CONTROL

As described elsewhere in this article.

Cat.# KC-5141 **$89.95**



KC-5141

AMPLIFIED WALKMAN SPEAKERS

We now stock two pairs of Walkman speakers, both with built in amplifiers. They will make your Walkman cassette or portable CD sound great, and enable everyone to hear what's playing. We evaluated quite a number of these speakers before deciding on these two, which offer excellent sound quality and value for money.

NEW

STEREO SPEAKER SYSTEM WITH DXBB

These speakers have a built in amplifier which delivers a genuine 3 watts to each speaker. They incorporate the following features: •DXBB - Dynamic Extra Bass Band control system which extends the high and low frequency response without overloading the amplifier. A LED shows you when DXBB is working. •Double Bass and Treble switches. When switched on the Bass and Treble is double normal operation. •Power Switch / Direct In. The amplifier can be turned off and the unit acts as an ordinary stereo speaker system. Power handling is 3 genuine watts. •Speakers can be locked together for easier handling. •Use 4 x C batteries or 6VDC mains adaptor (not supplied - use model MP-3010 $19.95). •Gold 3.5mm stereo plug supplied. •Size: 155(H) x 110(W) x 60(D)mm.

NEW

Cat #: AS-2960 **$39.95/pair**

HIGH POWER STEREO SPEAKER SYSTEM

NEW

These are the big brothers to the AS2960. Their built in amplifier delivers a genuine 4 watts to each speaker. Features include Double Bass and Treble switches, power LED indicator, large cabinets for better sound.The amplifier can be switched off and the unit acts as an ordinary speaker system. Gold 3.5mm stereo plug supplied. Use 6 x C size batteries or 500mA plug pack Cat MP3012 $22.50. Speaker size: 150(H) x 80(D) x 90(W)mm.

Cat #: AS-2962 **$49.95/pair**

CD/AUX TO CAR FM SOUND FEEDER

NEW

USE YOUR PORTABLE COMPACT DISC OR WALKMAN IN THE CAR!!! Sound Feeder is a convenient way to play your CD or Walkman on your cars stereo system. Sound Feeder converts the signal to FM which is picked up on your FM stereo receiver. Simply plug Sound Feeder into your cigarette lighter, connect the audio input wire to your portable player, tune in your FM receiver and you have STEREO sound. Sound Feeder also contains a DC to DC voltage convertor to drop the vehicles 12v to 4.5, 6 or 9v to power the portable player. Sound Feeder combination of stereo sound, easy installation, portability and power supply feature make it an ideal accessory for all cars. Supplied with four different DC power adaptors.

SPECIFICATIONS:

Operating voltage:	12-18VDC	Max input signal:	400mvppAudio
Consumption current: (no input signal)	22mA	input imp:	1 ohm
		Audio response:	50Hz - 15kHz
Tuning frequency:	88-108mHz	Size:	90(L) x 51(W) x 21(H)mm
Channel separation:	40dB	Cat #: AR-1750	**$47.95**

BUDGET AUDIO SWITCH

If your amplifier has not got enough inputs, this switch will help. It has two sets of RCA sockets for inputs and one set for output to the amplifier. This will allow two components (eg CD and Laser Disc) to be connected to the one amplifier input. Supplied in a plastic box with rocker switch for selecting input.

Size: 90(W) x 100(D) x 35(H)mm.

Cat #: AC-1656 **only $17.95**

NEW

NEW AUDIO CONTROLS

We are proud to introduce three quality audio switches. One is for input, the other two are for speakers. These are supplied in a heavy black anodised case with scratch resistant feet and gold writing.

NEW

2 WAY SPEAKER CONTROL

Have either or both speaker systems running with this switch. Simple screw terminals accept 79 strand cable. Suitable for speakers from 4 to 16 ohms. Size: 125(W) x 110(D) x 45(H)mm.

Cat: AC-1640 **$26.95**

3 WAY INPUT CONTROL

If your amplifier is lacking inputs - this will help. It has three sets of RCA sockets for inputs and one set for output to the amplifier. It will allow three components (eg CD, tuner, laserdisc, tape deck etc) to be connected to one input socket on the amplifier. This switch is about half the price of our old model.

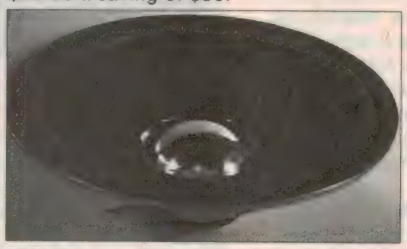
Cat: AC-1658 **$26.95**

4 WAY SPEAKER CONTROL

Connect from one to four pairs of speakers. Screw terminals accept 79 strand cable. Suitable for speakers of 8 ohms and more, and the switch ensures that the amplifier load will not be less than 50% of the speakers used. ie: If 8 ohm speakers are used the minimum load will be 4 ohm which is sufficient for virtually all amplifiers Cat: AC-1642 **$49.95**

MAGNAVOX 12W SENSATION LESS THAN HALF PRICE

We have purchased a quantity of the fabulous Magnavox 12W 12 inch speakers at a special price. This speaker is stocked by us and normally sells for $59.95. We have been able to slash the price to $29.95 a saving of $30.



Speaker Details

- Paper cone, foam roll surround, high temp 25mm voice coil
- 350g Barium magnet.
- Power handling:80WRMS.
- Freq range fo: 6000Hz,
- Sensitivity: 89.2dB/W/mt.
- Res. Frequency: 25.7Hz.

•QMS: 3.24 •QES: 1.12 •QTS: 0.83 •VAS: 362.1L.

Two box sizes - both sealed.

VOL (Litres)	50	100
Tuning Freq	73.8Hz	55.2Hz
Response Peak	6.01dB	4.13dB
-3dB Frequency	49.9Hz	38.6Hz
Qtc	1.93	1.52

Cat. CW-2122

Catalogue Price $59.95

Now Only $29.95

LOW PRICES ON CAR DOOR LOCKING SYSTEMS

We have changed suppliers and we are now stocking actuators that are made by the same people who make our quality car alarms. We have also been able to **reduce our prices**.

FOUR DOOR CAR POWER DOOR LOCK KIT

Consists of two master solenoids and two remote solenoids (masters are for the front doors so opening either front door will automatically unlock the other three doors). Also includes a full wiring harness to connect all doors and the power lock relay is also supplied. You can remotely control this system with our Remote Control Switch - Cat # LR-8822 $79.95 which includes two transmitters. Cat # LR-8830

was $169.50 now $119.50 save $50

SEPARATE ACTUATORS

If you own a two door car - you only need buy 2 actuators (2 masters or 1 master and 1 slave) and a power relay.

MASTER ACTUATOR	SLAVE ACTUATOR	POWER
Cat #: LR-8832	Cat #: LR-8833	LOCK RELAY
was $38.95	was $36.95	Cat #: LR-8835
now $28.95	now $26.95	$29.95
save $10.00	save $10.00	

OUTDOOR GARDEN LIGHTS

NEW

150 LIGHTS!!! These are bigger, better and cheaper than our old model that we had so much trouble getting. Have the best looking garden in the street. Completely prewired - simply hang them through your garden. Safe, low voltage (24V) supplied with a mains 240v plug pack.The set consists of a 240v plug pack, 15 metres of plain cableand 21m of cable with the 150 globes at 140mm spacing. All cable & globe bases are green so it easily hides in the garden. Current drain for all 150 globes is approx 2.1 amps.

Cat.#: SL-2830 **$69.95**

BATTERY TESTER

NEW

This device will test both 6 and 12 volt conventional car batteries and maintainence free batteries as used in solar power installations etc. To accurately check batteries state of charge the tester draws current while measuring its voltage level. It will check batteries with ratings up to 1,000 CCA (Cold Cranking Amps) and can load batteries up to 100 amps. It will also check the batteries cranking ability, test the vehicles charging system output and test the starter motor. Its simple to use, completely portable, external power is not required and complete tests on a battery can be done in 30 seconds. Its accurate and dependable, with a shock resistant movement, heavy duty colour coded copper plated battery clamps and a heavy duty nickel-chrome plated steel case.

Size: 290(H) x 160(W) x 70(D)mm. Cat #: QM-1620 **$89.95**

VISION-MATIC GLASSES

NEW

Vision-Matic are plastic glasses that incorporate one torch globe on each side for hands free illumination. They are ideal for many situations where the user needs a good torch light and both hands free. Use •for working on the car •camping •night reading •blackouts •night fishing, boating, walking etc etc. Vision-Matic glasses can be worn over conventional glasses. They require 2 x AA size batteries for each side (4 in all - not supplied). Globes are standard pre-focused torch globes. it also has a belt clip built in for easy carrying.

Cat #: ST-3025 **$14.95**

WHOLESALE DEPT: (02) 743-5222

WINDOW ALARM

This window alarm is the best unit we have seen by far. Most window alarms are hard to use, but not with this one. It's ideal for use on windows, doors, medicine cabinets, closets, stereo cabinets etc etc. It's easily attached with double sided tape or screws (both supplied). It has an instant trigger, loud beeping alarm, easy installation, no wiring, automatic alarm cut off after 30 seconds and it can be re-triggered. Requires 2 x AAA batteries. This unit features a hidden switch which makes it easy to use and turn off.

NEW

Size (each unit): 131 (H) x 22(W) x 24(D)mm.

Cat: LA-5095 **$17.95**

DOOR WATCHDOG

After the success of our Electronic Watchdog alarm, we have found a much cheaper door knob model.

To use, simply place over the door knob on the inside and switch on. It's designed to be used on round type door knobs that are common in flats and newer homes.

As soon as someone touches the door knob outside, the unit starts barking like a dog. It is an excellent deterent, and offers inexpensive piece of mind for our older community, and people alone.

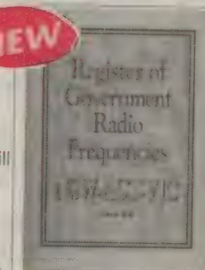
Features include: •simple operation - switch on to use •adjustable volume control •loud barking dog sound alarm •electronic touch activated sensor •adjustable sound volume. Unit requires a 216 9 volt alkaline battery (Cat: SB-2395 $6.30).

NEW

Cat: LA-5282 **Only $24.95**

REGISTER OF GOV'T RADIO FREQUENCIES - NSW/ACT/VIC

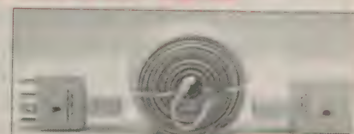
NEW



Ideal for Scanner Listeners. Now you will know who you are listening to. Includes frequencies for Police, RTA, SES, Defence, Fire Brigades, Ambulance, Hospitals, Government Departments, National Parks, Water Board, Qantas etc etc etc. 76 pages 295 x 207mm

Cat: BC-1135 **$27.95**

PHONE EXTENSION LEAD



NEW

This lead has a 15 metre length of telephone cable with a U.S. 4 pin plug on each end. Also supplied are two adaptors. One accepts the U.S. plug and converts it to an Australian plug. The other adaptor is from the U.S. plug to and Australian socket. So you can have any combination of U.S. plug to Aust plug, U.S. plug to U.S. plug or U.S. plug to Aust socket all 15 metres long. Adaptors cost $6.50 each and the lead is about $8. That's over $20 value.

Cat #: YT-6050 **A BARGAIN AT $9.95**

AA NICAD BATTERIES

700mAh with solder tags - Cat. #: SB2451
$3.75 each

500mAh rechargable - Cat. #: SB-2452
4 for $10.00

500mAh with solder tags - Cat. #: SB2453
$2.95 each

700mAh rechargable - Cat. #: SB2450
$3.50 ea or 4 for $12.50

TV ANTENNA AMPLIFIER

Handy device designed for indoor use simply plugs into a power point. The antenna lead is plugged through the amplifier. Its ideal for low reception areas or installations where several TV's are being used from one antenna.

•Adjustable gain: 0-20dB •Attenuation: -12dB •Max output: 98dBuV •Boost frequency: 40-900mHz •Noise: 5dB. This covers UHF, VHF and FM signals. Input / output is a coax TV socket.

NEW

Cat # LT-3282 **$49.95**

Jaycar ELECTRONICS

HEAD OFFICE
6 Leeds Street Rhodes 2138
Telephone (02) 743 5222
FAX (02) 743 2066

POST & PACKING

$10 - $24.99	$ 3.75
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Special 'Learn While You Build' Construction Project:

BUILD YOUR OWN AM-FM PORTABLE RADIO - 2

Here's the second article describing our new 'learn while you build' radio receiver project. This month we explain how the radio is built up — in easy to follow stages — and then how it's aligned, so that it works correctly. There are plenty of diagrams to guide you, each step of the way, and even a section at the end giving tips on troubleshooting in case it's needed.

by JIM ROWE

Now let's turn to the part of the project you're probably most interested in: putting it all together. The first phase is to wire the smaller electronic components on to the PC board. This is best done in stages, as follows.

First, mount the seven resistors R1-R7, plus electrolytic capacitors C15-22, on the board as shown in the overlay diagram of Fig.4. (Note that the diagram shows the PCB copper pattern, even though it's actually on the rear of the board; this is merely to guide you in locating each part correctly.) The resistor colour code box can be used to identify the various resistors, by their colour code bands.

Note that all of the components are mounted on the top of the board (the side without the copper connection tracks), with most of the resistor leads bent so that the resistor itself can lie down flat against the board, with its leads passing down through the appropriate holes and soldered underneath. The excess leads are then cut off.

The only exception to this is R3, which needs to stand almost on end, with the top lead bent back down to pass through its hole.

Note too that the electrolytic capacitors are all polarised, and must each be mounted on the board with its '+' polarity sign on the side shown in the overlay.

After mounting all of the first group of components, it's a good idea to fit the wire link which joins pins 5 and 20 of the IC (when it's later fitted). The position of the link is shown in Fig.4; it's supplied as a 40mm length of tinned copper wire, whose ends you bend down so that they can be passed through the holes and soldered.

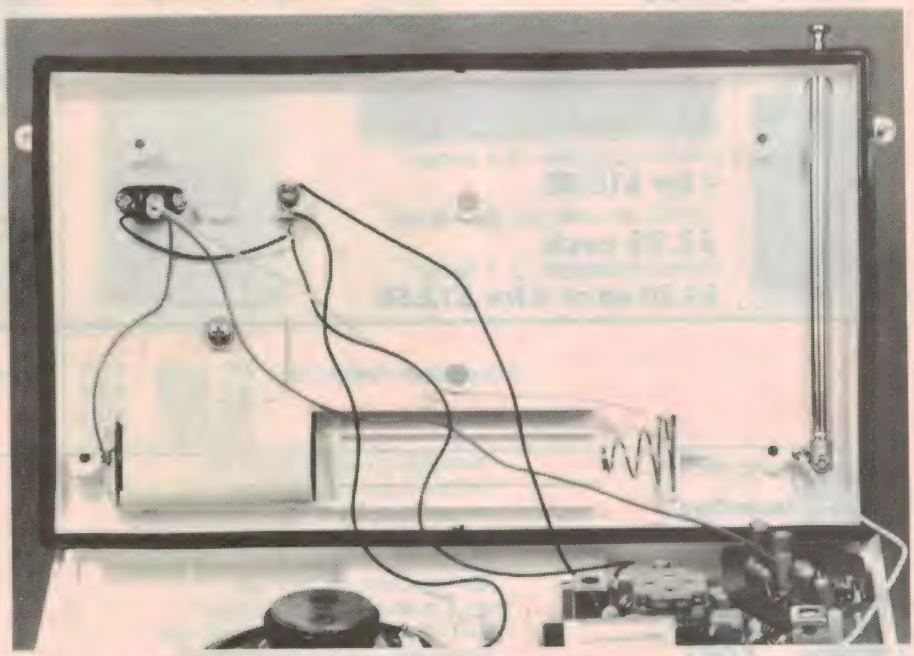
The next step is to fit the small ceramic and metallised polyester capacitors C1-C14. These are shown in the next overlay diagram, in Fig.5. Note that none of this second group of capacitors is polarised; they can be connected either way around. But they should be fitted as close to the board as possible, without straining their leads.

(Although the ferrite rod and coil which form the AM antenna are also shown in Fig.5, these are not fitted for a while. We'll return to them shortly.)

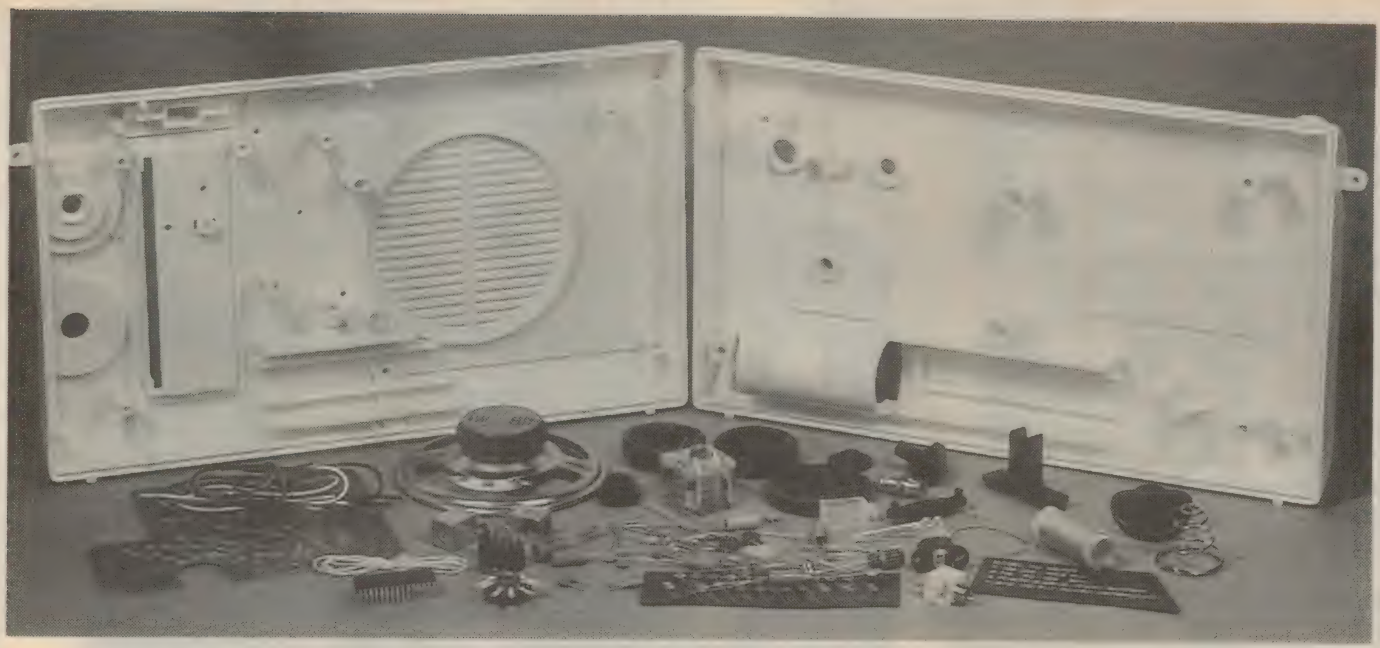
Now you can fit the next group of components onto the PCB — the IC, the smaller coils and transformers, the ceramic resonators, the volume control pot/power switch, the band switch and the tuning capacitor. These are all located as shown in Fig.6. The things to watch here are as follows:

Like most ICs, the Sony CXA1019S must be fitted the correct way around. Note that one end of the package has a small semicircular 'dimple' in the centre, and a smaller circular depression over near pin 1.

The IC should be fitted to the PCB with *this* end nearest resistor R5. Make sure all of its pins pass through their correct holes, before soldering them to their copper pads. The pins and pads are closely spaced, too, so be careful you don't 'bridge' between them accidental-



This photo shows the wiring to the parts which are mounted on the rear half of the case. At upper left are the DC input and earphone jacks, with the battery connection plate below them and the battery spring and antenna at lower right.



ly with solder. (Make sure you've already fitted the pin 5 to pin 20 link *before* fitting the IC, too!)

The AM oscillator coil 'IFR' and IF transformer 'IFY' are both housed in small square-section cans, each of which has five connection pins on the bottom plus two lugs to anchor the outside shield can. But despite their similarity, the two are quite different inside — so don't swap them.

To identify which one is which, look at the colour of the slotted adjustment slug inside the top: the AM oscillator coil has a *red* slug (hence IF**R**), while the IF transformer has a *yellow* slug (hence IF**Y**). Note that both coils will only fit into the PCB one correct way, and that all five pins and two lugs should be soldered to the copper pads.

There are three small 'naked' coils, for the FM front end tuning. Two consist of 3.5 turns of wire, with green insulation; these are the 'FM3' coils, one of which fits between capacitors C4 and C5, and the other between C5 and C2. The third coil has only 2.5 turns of wire, with gold insulation; this is the 'FM2' coil, which fits between capacitor C3 and the AM oscillator coil IFR.

Again, there are three ceramic resonators: two with *three* closely-spaced connector pins each, and one with only two pins. The latter looks a bit like a small capacitor, but is longer and with a blue body having a red spot on one side, and a code '10.7C' on the other. This two-pin resonator is the FM discriminator resonator, shown as 'FMD' in Fig.6 and which fits next to R7 and C17. The three-pin resonator marked 'U455Y' is the AM IF filter unit 'AMC', which mounts just below transformer IFY. And the remaining three-pin unit, marked 'E10.7A', is the FM IF filter unit 'FMC', which mounts alongside R2. All three resonators can be fitted either way around.

Unlike virtually all of the other small components mounted on the PCB, the volume control pot/power switch mounts on the copper track side, with its lugs against the copper tracks and pads, and its switch 'works' sitting in the large semicircular hole in the PCB (see photo). It's actually attached to the board via two of the small 'eyelets', which pass through holes in the outer (switch) lugs and then through matching holes in the PCB.

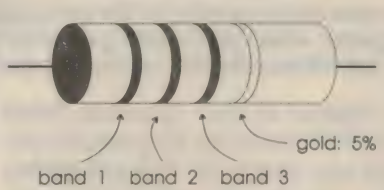
With the pot and switch assembly held tightly together, the eyelets and lugs are then soldered together, and the outer ends of the same switch lugs soldered to the adjacent PCB pads. The three inner pot lugs can then be soldered to their respective pads, too, making sure the pot is 'square' so that its shaft axis is at right angles to the PCB.

The band switch is a small 'slider' type, with six connection lugs and two location pins, which mounts on the PCB at the top near the centre (and back on the component side).

Note that it mounts with the actuator lever pointing upward, away from the rest of the board. The end location pins also need to be soldered to the PCB pads, to attach the switch securely, and as these pins are covered in black lacquer, you'll have to scrape or file off the lacquer from them so that the solder will bond to the metal.

The tuning capacitor has six main connection pins or straps — three on each side — plus a shorter seventh pin on the bottom. This smaller pin allows you to orientate it correctly. Note that the longer side pins may need to be straightened before they'll all pass through their respective slots at the same time. The tuning capacitor itself is attached to the board via a pair of 2.5mm diameter countersink-head machine screws 3.9mm long, which pass through the board from the copper side, and mate with the tapped holes on the front (spindle side) of the capacitor body. The capacitor should be mounted to the PCB in this way before the seven connection pins are soldered to their pads.

RESISTOR COLOUR CODE



black	0	Band 1 colour:
brown	1	first number
red	2	
orange	3	Band 2 colour:
yellow	4	second number
green	5	
blue	6	Band 3 colour:
purple	7	number of zeros
grey	8	
white	9	

This diagram, showing the standard colour code, will guide you in selecting the resistors used in the radio .

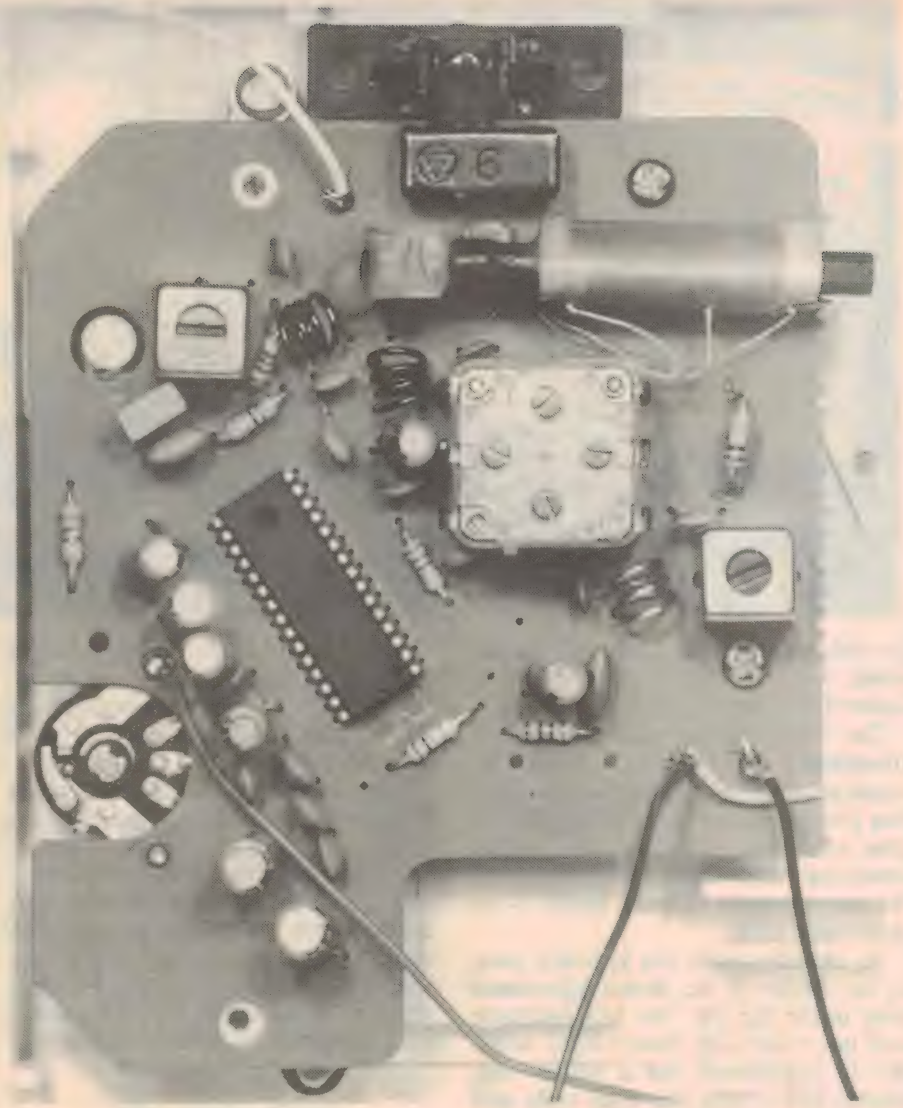
After you've mounted the tuning capacitor itself, you can fit its plastic 'adaptor bracket' to the front spindle. This is a small moulded item about 31mm long and 9mm wide, with two small spigot pins at the ends on one side, and a central 'boss' on the other.

The boss has a specially-shaped hole, to mate with the end of the capacitor spindle — which you'll find has two machined 'flats'. The adaptor pushes onto the capacitor spindle, after carefully mating the hole and spindle flats, and then a countersink-head machine screw 2.6mm in diameter and 4.8mm long is used to fasten them together properly.

Similarly, a small plastic 'adaptor ring' can be fitted to the spindle of the volume control pot. This item is 15mm in diameter (almost exactly the same as the pot body), and one side is flat with a small hole especially shaped to mate with the spindle of the pot.

After the two are mated together, the tiny round-head machine screw 1.6mm in diameter and 4.9mm long is used to attach the adaptor securely.

The three remaining eyelets are used to form connection 'terminals' on the PCB, for the speaker and FM antenna connections. Two mount down in the bottom right-hand corner, while the third mounts up at the top, just to the left of the band switch. They're pushed through the PCB holes from the copper track side, and soldered to the pads to anchor them.



Use this close-up view of the completed PCB as a guide, along with the wiring diagrams, when you're wiring up your own board. You can also see here the way the AM-FM bandswitch mates with the actuator behind the knob (at top).

Antenna rod

The final component to be mounted onto the PCB is the ferrite AM antenna rod (or 'bar' as it's called in Fig.5). This is attached to the board at one end, via a small plastic holder — one end of which is keyed so it slips into a small rectangular hole in the PCB, and then the holder is turned by 90° to fasten it in place.

This brings the holder's large rectangular slot into position so that the antenna rod can be slid in from the right-hand side. If desired, the holder and rod can be secured to each other and to the PCB using either hot wax or a suitable adhesive — but only secure the rod near the left-hand end, leaving most of its length free to take the coil.

The AM antenna coil assembly can then be slipped over the rod from the free end, and its three connection wires passed down through the hole about 3mm in diameter, just above and to the right of C2. The wires are then separated and soldered to their respective points on the PCB, as shown. Note that the red-coded wire goes to the PCB pad marked 'XR', while the blue-coded wire goes to the 'XB' pad (IC pin 11); the uncoded wire goes to pad 'XU'.

By the way, don't cement the coil to the antenna rod at this stage; it has to be adjusted to the correct position, during the alignment process later.

At this stage your PCB assembly is virtually complete, and you can put it aside while you prepare the front and rear halves of the case.

Case front half

Inside the front half of the case are mounted the speaker, the tuning knob and dial assemblies, the volume control knob assembly and the knob/actuator assembly for the band switch. We'll now look at these in turn.

Speaker: The speaker is glued into place, in the large circular recess moulded into the rear of the front panel (behind the grille slots). This is done by placing the speaker with its plastic 'cone' facing down, and its terminals on the left facing towards the tuning dial end of the case.

Then a thin 'bead' of silicone adhesive or similar should be applied carefully, only around the edge of the speaker frame. Don't apply too much, or it might run onto the cone and effect the final sound quality.

Tuning knob assembly: Locate the tuning knob shaft and bush assembly. (The shaft is only about 20mm long, and has a shallow 'V' groove at one end, and a knurled end at the other.) Insert the bush in the upper control knob hole in the front panel, from the inside, and so that the knurled end of the shaft is on the

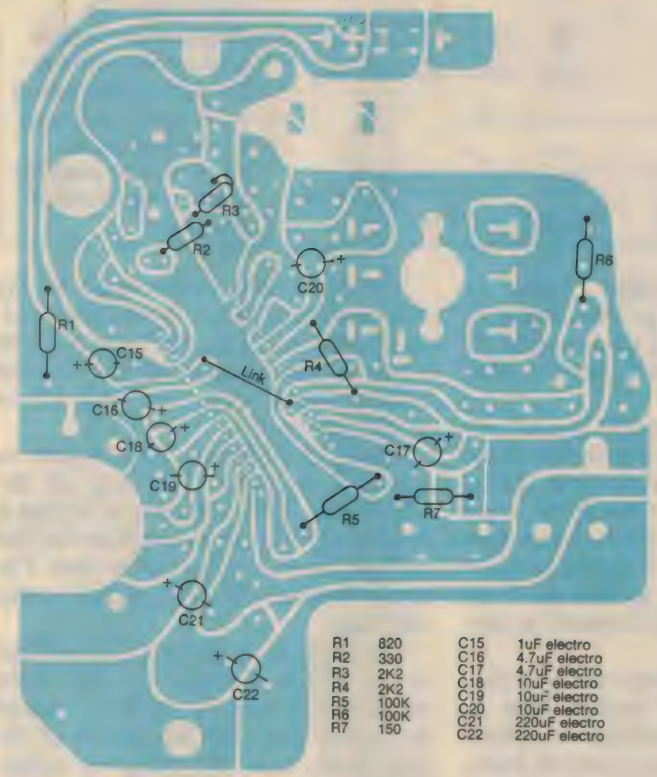
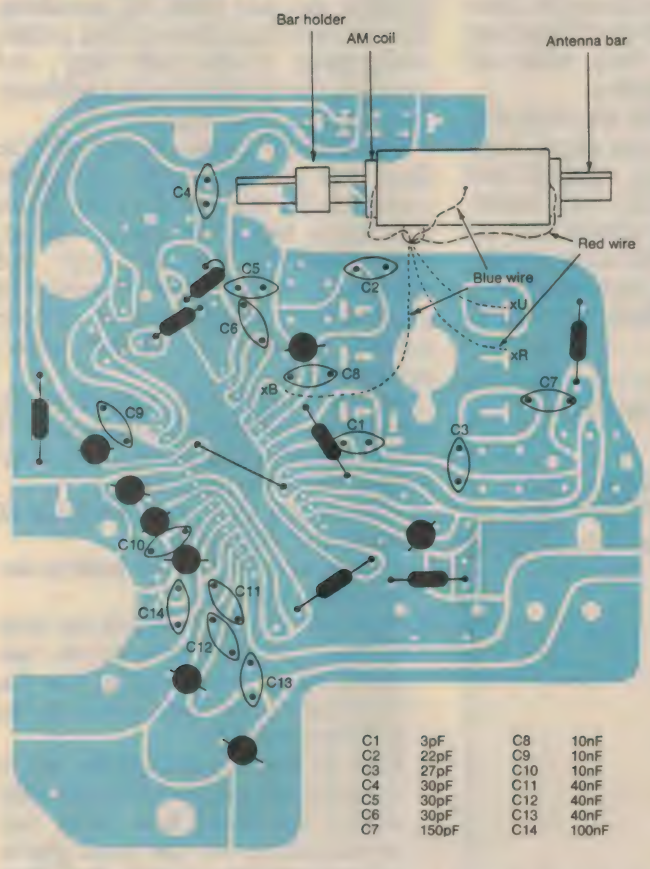


Fig.4 (left): This diagram shows the components that are added to the radio's printed circuit board for the first stage of its assembly. Take care with all of the capacitors shown here, to fit them the correct way around as shown.

Fig.5 (lower left): The components that are fitted in the second stage of assembly are shown here in outline form, with those previously fitted in stage 1 shown in black. Take special care with the connections to the AM antenna coil.

Fig.6 (below): The components that are added to the board in the final stage of its assembly are shown in this overlay. Note that the circles with crosses in them indicate the screws that are used to fasten the completed board into the front of the case — after you've fitted the adaptors to the spindles of the tuning capacitor and volume control.



outside. (Note that the panel hole has a recess with flat sides at the rear, to mate with the flats on the bush and prevent it from rotating.) Then secure the bush in place by fitting its nut at the front. Fig.7 shows the idea.

Ensure the nut is done up reasonably tightly, but not to the point where the threads start to strip, or there is undue strain on the plastic case. The tuning knob itself can now be fitted with its foam plastic washer underneath (23mm outside diameter, 9mm inside diameter) and pressed into place on the front end of the shaft. (It's the knob with the knurled shaft hole, logically enough, and you need to align the splines...)

Volume knob assembly: At this stage you can also fit the volume control knob assembly, in the lower control knob hole. This knob has a stub shaft on the

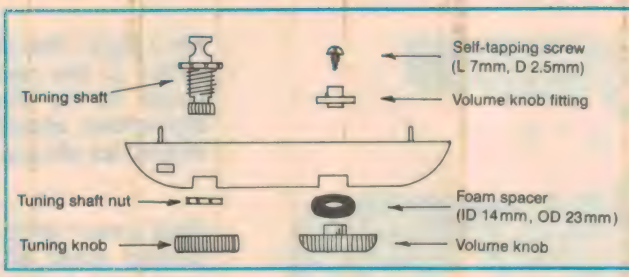


Fig.7: Use this diagram as a guide when you're fitting the tuning knob stub shaft and knob, and also the volume knob and its adaptor boss to the front of the case.

rear, and basically mates with a plastic bush piece which is stepped in diameter, measuring 16mm at its widest. The bush piece actually mounts in the panel hole, with its smallest diameter towards the front, and the small hole at the front mates with the knob — whose stub shaft has moulded flats.

The two are then fastened together with a 2.5mm diameter self-tapping screw 7mm long, screwed into the back of the knob from the rear, through a hole in the bush.

To fit the volume knob, first locate the knob itself, the bush piece, the second plastic foam washer (23mm OD, 14mm ID) which again goes under the knob at the front, and the self-tapping screw. Fit the foam washer under the knob, and the bush piece into the panel hole from the rear.

Then by bringing the knob and foam washer to the panel and rotating them carefully against the protruding front of the bush, you'll find the position where they mate together. Then just apply gentle pressure, to hold them in position while you fit the 9mm self-tapping screw (pointed end) and tighten it up. Fig.7 can be used for guidance here, as well. Again don't overtighten the fastening screw, or you might damage the plastic parts. The volume knob should be able to rotate easily.

Tuning dial assembly: Since the tuning shaft and knob are now in place, the tuning dial assembly can be installed. First identify the plastic dial drum, which is circular (37mm in diameter) and with a groove around its periphery. Note that it has one side almost flat, and the other recessed with two moulded hooks.

After carefully removing any moulding 'dags' with a hobby knife, the drum should be fitted onto the split plastic 'stub shaft' extrusion inside the front half of the case, directly behind where the dial scale will go; it should be fitted flat face downwards, so that the hook side is accessible, and it should be able to rotate freely.

Next, identify the three dial cord pulleys, which are all around 7mm in diameter and with a small groove around their periphery. There are two of brass, and one of plastic. Also locate the three fibre washers to go with the pulleys; one has a 3mm diameter hole, while the other two have 2.5mm holes.

The fibre washer with the 3mm hole and the two *brass* pulleys are all fitted onto the 3mm-diameter moulded stub shaft at the top of the case front moulding, just to the left (as viewed from inside) of the band switch actuator hole. The shaft concerned is also just above a larger pillar, one of those provided to support the PCB.

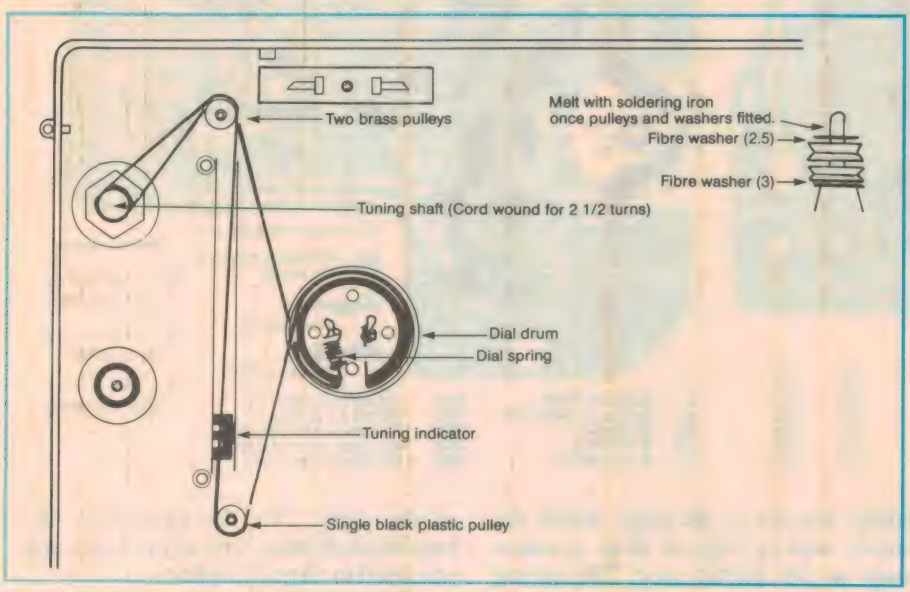


Fig.8: If you use this diagram as a guide, stringing the dial cord should not present any problems. Note that the two brass pulleys fit to the spigot at the top of the dial, while the single black plastic pulley fits to the lower spigot.

The 3mm fibre washer goes on the stub shaft first, then the two brass pulleys. Then one of the fibre washers with a 2.5mm hole is fitted, and pushed down until it meets the 'step' just above the top pulley.

Finally a soldering iron is used to carefully melt the very top of the plastic stub shaft, enlarging it so that it holds everything in place. Note that the pulleys should still be free to turn. The detail drawing in Fig.8 should make this clear.

The single black plastic pulley mounts in a similar fashion on the 3mm moulded stub shaft just at the bottom of the tuning dial, near the bottom of the case front. Here the pulley is simply fitted to the stub shaft, the remaining fibre washer fitted above it and pushed down gently to the shaft 'step', and again the plastic melted with a soldering iron to secure them in place.

The dial scale plate should now be fitted into position, in the rectangular recess on the front of the case. Make sure this is facing the correct way up, with 'FM/AM' at the top and 'MHz/kHz' at the bottom. Secure it in position with a tiny drop of silicone contact adhesive or similar under each corner.

Next, you're ready to fit the dial cord, spring and dial pointer. This can be a tricky process, and may take several attempts. Here's the procedure:

1. Make a slip knot at the very end of one end of the cord.
2. Tie the other end of the cord to one end of the spring.
3. Hook the slip knot end of the cord to the right-hand hook of the dial drum, when it is turned so that the small gap in its outer rim is at the bottom (see Fig.8).
4. Pass the cord out through the gap in the drum, wind it *anti-clockwise* once around the drum, then down and around (clockwise) the small plastic pulley at the bottom of the dial. Then take it straight up and anti-clockwise around the *lower* brass pulley at the top of the dial, and over to the tuning knob shaft. Here wind it *clockwise* around the shaft 2-1/2 times, and then back to the *upper* brass pulley, where

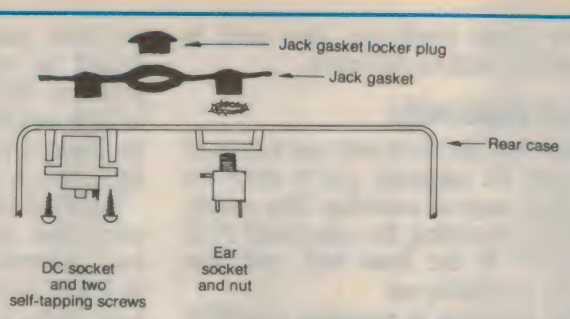


Fig.9: Another detailed diagram, this time showing how the DC input and earphone jack sockets are mounted to the rear of the case. Note that the DC socket is fitted with its centre connection lug upwards.

it goes around clockwise. From here it goes to back to the dial drum, going around it anti-clockwise to the gap — where the cord ends with the spring terminated comfortably and under a small amount of tension, on the other (left-hand) hook of the drum.

5. Once the tuning cord is in place satisfactorily, the tuning pointer can be fitted. The pointer section is simply poked through the slot in the panel from the rear, and then the slot in the base positioned so that it slips down on the long thin vertical slider strip moulded in the panel alongside the slot. The pointer should then be able to slide up and down freely.

With the dial drum and pointer both positioned as shown in Fig.8, the dial cord should be attached to the pointer by pushing it down under the centre lug on the rear of the pointer base. This should allow you to confirm that the pointer can be moved simply up and down the tuning dial, by turning the tuning knob.

The cord can be finally secured to the spring, dial drum hook and pointer with a small dab of nail polish, but only after you are happy that everything is working as it should. As the pointer moves up the tuning scale, the gap in the dial drum should move around anti-clockwise from the '6 o'clock' position to the '12 o'clock' position, and the cord should not chafe against anything — including the gap in the drum.

If for some reason there's a problem and the cord is too tight or too loose, the cord may slip on the tuning knob shaft when the knob is turned.

In such a case, if the position of the knots at the ends of the cord are hard to correct (to either shorten or lengthen the effective cord length, and hence adjust the tension), then a small amount of resin may be applied to the groove in the tuning knob shaft to afford greater 'grip' on the cord. But this should only be as a last resort — the spring should ensure that the correct grip is maintained.

Band switch knob/actuator: The band switch actuator is attached to the back of the band switch slider knob (but on the inside of the front panel), and is used to operate the switch itself, when the PCB assembly is mounted. To assemble the knob and actuator, first fit the rear of the knob (it's about 26 x 13mm, with a shaft leaving the centre rear at an angle) with its correct foam washer (rectangular, with a centre hole). The washer is adhesive backed, and sticks to the rear of the knob. Then place the knob in position from the front of the panel, with its shaft pointing through the slot.

The actuator (a 'T' shaped moulding with twin 'verticals', 34mm long across the top) is then positioned behind the knob shaft, so that the small oval hole at the centre of its top arm mates with the shaft, while the slots at each end slip over the ridges moulded into the rear of the panel. A 9mm long self-tapping screw (pointed end) can then be used to fasten the actuator and knob together, from the rear.

Do not overtighten this screw. The band switch knob should be able to slide comfortably from side to side.

The front half of the case is now complete, apart from some external cosmetics, and you're ready to assemble the rear half.

Case rear half

The rear panel mounts the earphone and DC power adaptor sockets, the telescopic rod antenna for FM reception, the battery connectors and the battery compartment door latch.

Fig.9 shows the way the two sockets are fitted. The earphone socket is secured by its own nut, while the DC power socket is secured by two self-tapping screws (9mm long, pointed end). Note that the DC socket is fitted with its centre connection lug upwards, so that the pin inside is in the centre of the panel hole as viewed from the outside.

Fit the water-resisting 'jack gasket' into the outside of the two socket holes, attached to the rear of the case via the 'jack gasket locker plug', in the centre hole.

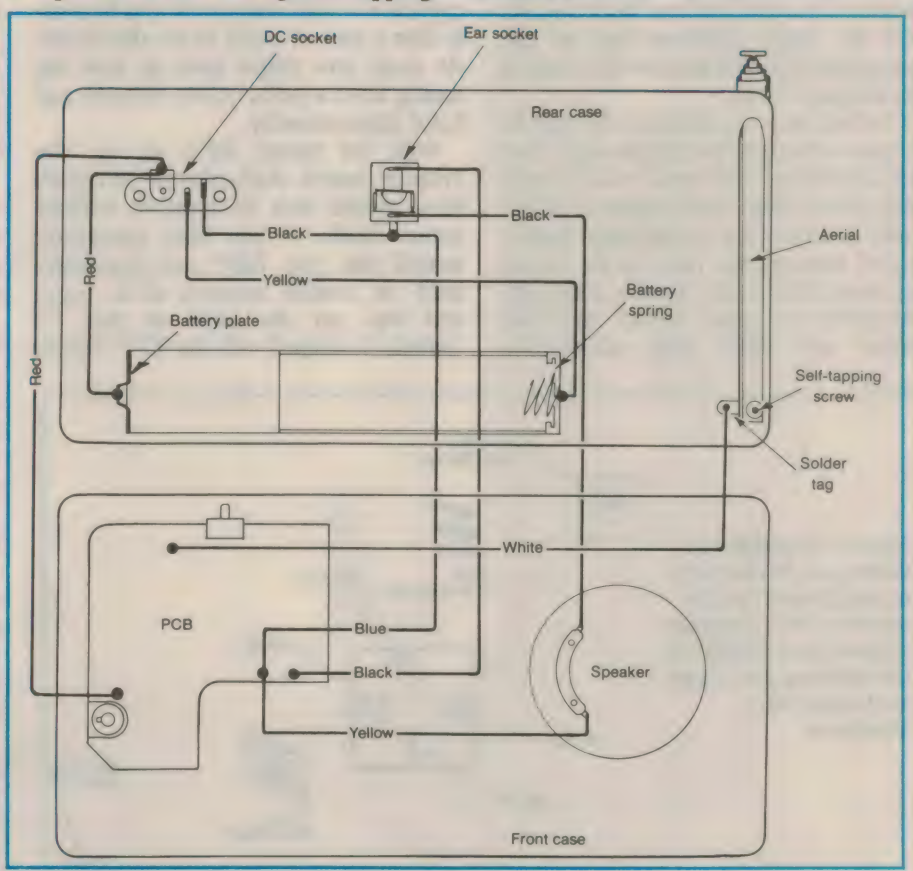


Fig.10: To guide you in wiring up the PCB with the other components, here is the corresponding wiring diagram. Use it in conjunction with the photographs, to make sure your unit is wired in the same way.

Now fit the telescopic FM rod antenna, which slides in through a hole in the top of the right-hand end of the case rear, looking from the inside.

The milled flat on the lower end of the rod sits on the small moulded spigot at the lower right, with a small solder lug placed underneath to make the electrical connection to the antenna. A 9mm long self-tapping screw (pointed end) is then passed through the hole in the rod and the solder lug, to secure them both in position on the spigot.

Next fit the small plate used for the positive battery terminal, by pushing it down into the slot at the left-hand 'covered' end of the battery compartment, with the connection lug extending upwards.

Note that both the central 'dimple' and the two smaller 'locking teeth' should be facing into the battery compartment. Take care to push the plate in squarely, so you'll be able to bend the connection lug over slightly to locate it in the moulded slot.

The large conical spring used to form the negative battery terminal fits in the slot at the other end of the battery compartment, as you can see from Fig.10. Here the larger diameter end of the spring simply slides into the slot, until it hits the small stops.

The last item mounted on the rear of the case is the battery compartment door latch, a kind of 'half knob' which has a small round foam washer placed underneath, and then the central stub shaft is pushed through the hole in the recess just above the battery opening in the outside of the rear panel. A 9mm metal flat washer and 7mm long self-tapping screw (large head) are then used to secure the latch on the inside.

Final assembly

Now that the front and rear halves of the case are prepared, you're ready for the final stage of assembly. This mainly involves mounting the completed PCB assembly in the front half, and then wiring everything up.

The first step is mounting the PCB, and this is a little tricky because two sets of items have to be correctly mated in the process: the pins of the 'adaptor bracket' on the front of the tuning capacitor shaft have to be correctly mated with the right pair of holes on the tuning drum, and the 'shaft adaptor' on the front of the volume control pot has to be correctly mated with the boss at the back of the volume control knob.

To line up the tuning shaft adaptor correctly with the dial drum, first rotate the tuning capacitor shaft and adaptor fully *anti-clockwise*, as viewed from the front (copper side) of the PCB. Then adjust the tuning knob so that the dial pointer is at the *bottom* end of the dial scale.

Next offer up the PCB to the rear of the panel, and the pins of the capacitor's shaft adaptor should fit neatly into a pair of holes in the dial drum. At most you might have to turn the tuning knob a little, before the pins and holes align correctly.

With the tuning drive set up, the volume control shaft adaptor and knob boss should also fit together without undue hassle. If you have previously turned the pot fully anti-clockwise, until its switch contacts click open, and also set the knob so that its 'pimple' is aligned with the 'OFF' dot on the front panel, the adaptor and boss should be very close to their mating positions. All that you'll hopefully have to do is turn the knob in one direction or the other by a small amount, before they slip together.

The PCB can now be secured in place, using two self-tapping screws (9mm long, pointed end) positioned as shown in Fig.6. Note that two further 4.5mm holes in the PCB simply fit over spigots in the case front, to locate it as well. When the rear of the case is fitted, the case assembly screws provide additional securing of the PCB.

At this stage many of the remaining case parts can be fitted; the gaskets around the clear plastic dial 'glass' and the battery compartment, the labels and the red 'dress' line which runs down the front at an angle. These can all be held in place with a few *very small* drops of contact adhesive. The dial 'glass' is mounted before the gasket, which fits in the groove around its edge.

You should also insert the pieces of foam plastic into the centre of the open coils, on the PCB. This is purely to take up space and prevent any other foreign material from entering the coil and changing its inductance, which would affect the performance of the radio.

The radio can now be wired up inside, using the wiring diagram of Fig.10 as a guide. Note that the various lengths of hookup wire used are supplied pre-cut to length, and are colour coded.

Once the unit is wired up, do a final check then install the batteries — with their negative terminals towards the spring contact end, and their positive terminals towards the plate.

Now turn the radio on and advance the volume control. If you do not hear the usual hiss or crackle of a radio off-station, switch off and turn to the section headed 'troubleshooting'. But if things sound reasonably normal, you should be ready for alignment.

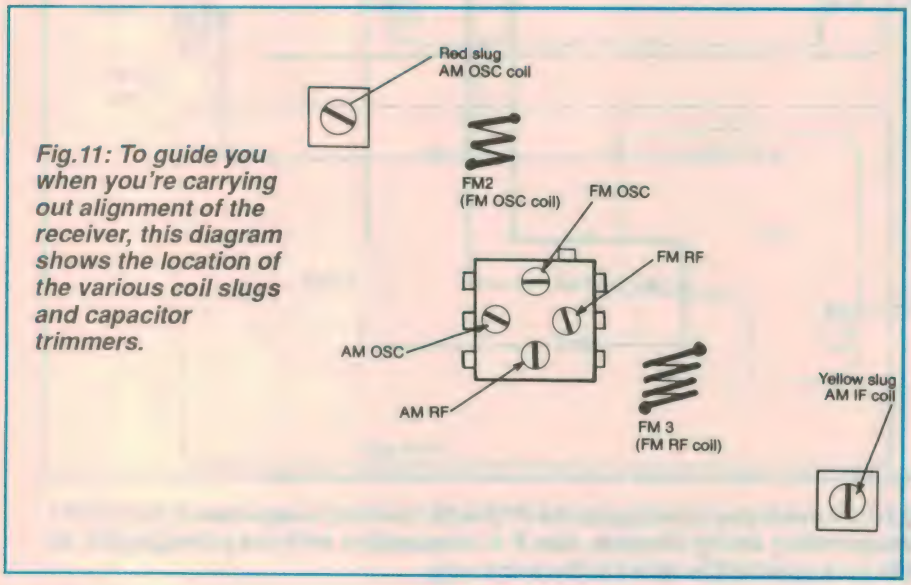


Fig.11: To guide you when you're carrying out alignment of the receiver, this diagram shows the location of the various coil slugs and capacitor trimmers.

AM alignment

The alignment of the AM section involves two main operations: getting the tuning range to correctly match what is shown on the dial scale, and peaking the tuning of the receiver for best signal strength and reception across this range.

To do this you will need to know two radio stations, one near each end of the AM band, and their frequencies. These details are normally available from the newspaper. It may be useful to have a second AM radio nearby to check that the stations are broadcasting and available at useful strength.

Here these stations will be referred to

as the *top* and *bottom* stations, where the 'top' station is the one with its frequency near 1500kHz, and the 'bottom' station is the one with its frequency near 550kHz. Which stations these are will vary from area to area and state to state. Of course if you have access to an RF signal generator, then this can be used instead — simply setting it in turn to the frequencies required (say 540kHz and 1600kHz).

The basic idea of the alignment process is that with the radio tuned to these frequencies one after the other, its local oscillator is first adjusted so that the dial pointer indicates the correct receiving frequency (steps 3 and 4 below). Next the AM aerial coil is tuned for best reception, and finally the AM IF transformer is also tuned to achieve the best reception (steps 5 and 6).

For these operations you'll need a non-metallic tool, such as an 'alignment tool' or a ceramic screwdriver. Or you can fashion one yourself, by filing the end of an old plastic knitting needle to a flat 'screwdriver' shape.

Ready for the alignment? Right — here we go:

Step 1: Adjust each of the four trimmer capacitors (inside the rear of the tuning capacitor) to their *half-way* settings — i.e., turn them so that the adjustable half-circles are half meshed with the fixed half-circles.

Also adjust the 'slugs' in both the AM oscillator coil (red slug) and the AM IF transformer (yellow slug) to halfway through their adjustment range. By the way, don't use force in adjusting these slugs — they're made of ferrite and may chip or crack if adjusted with sharp tools or with excessive force.

Step 2: Try tuning your radio to locate the 'bottom' station. Note the frequency indicated by the dial pointer, which will probably be either below or above the correct frequency for the station. (If you cannot receive the station at all, the odds are that your radio as yet can't tune low enough.)

Step 3: If your dial indicates *below* the correct frequency, then you need to turn the red slug of the AM oscillator coil clockwise, to move it further into the coil, until the station is received at the correct indication. This is also the direction to turn the slug if you can't receive the station at all, with the pointer right at the 'end stop'.

On the other hand if your dial indicates *above* the correct frequency, then you will need to turn the slug anti-clockwise, to bring it further out from the oscillator coil.

The objective here is that you should be able to position the dial pointer exactly for the frequency of the lower station, and by tuning the red oscillator coil slug ensure that the station is being received correctly.

Step 4: Now tune the radio to the 'top' AM station, and again note whether it shows on the dial as being below or above its correct frequency. If the dial indicates *below* the correct frequency, then you'll need to adjust the AM OSC trimmer in the tuning capacitor (see Fig.11) such that its vanes are *more* enmeshed. This gives more capacitance, which will lower the receive frequency relative to the dial indicator.

(NOTE: DON'T re-adjust the oscillator coil slug! The slug is used for setting the bottom end of the dial, and the trimmer for setting the top end.)

If on the other hand the dial indicates *above* the correct frequency, you'll need to adjust the AM OSC trimmer so that its vanes are *less* enmeshed. This gives less capacitance, which increases the oscillator frequency.

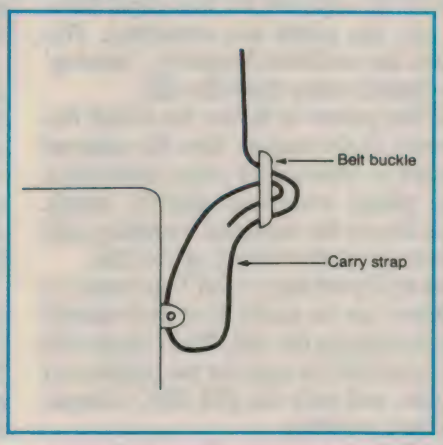


Fig.12: This diagram shows how to fit the carrying strap and its buckle to each end of the case.

Again the basic idea is that you should be able to position the dial pointer exactly to the correct frequency for the top station, and tune the AM OSC **trimmer** until the station is received correctly.

As the top and bottom settings interact with each other a bit, it's a good idea to repeat steps 3 and 4 several times, until you are happy that both adjustments are optimised. Just remember that the red coil slug is only used for the bottom adjustment, and the AM OSC trimmer only used for the top adjustment.

Step 5: Now tune to the bottom AM station again, and carefully slide the AM antenna coil along the ferrite rod until you find the position that gives the best reception. Secure the coil temporarily in this position, perhaps with a tiny strip of sticky tape.

Step 6: Now tune back to the top AM station, and this time adjust the 'AM RF' trimmer on the tuning capacitor (Fig.11) for the best reception of this station.

Again it's a good idea to repeat steps 5 and 6 several times, or until you are happy the adjustments can't be further improved. As before, remember that the coil is used to set the bottom end, and the trimmer the top end.

Once the radio has been tuned to your satisfaction, and the stations align with their correct frequencies on the AM dial, secure the AM aerial coil more permanently onto the ferrite rod with several drops of candle wax, or a tiny drop of silicone glue at one end. Your AM alignment is now complete.

FM alignment

The theory here is essentially the same as for the AM alignment. Adjustment may be necessary to the FM oscillator tuning to make the receive frequencies line up with the tuning dial. Once this is done the RF circuits are then tuned for best reception.

Again if you have an RF signal generator, this can be used. However without a generator, you again only need an FM station signal with a frequency up near the top end of the dial, and another down near the bottom end. As before you can use another FM radio to establish which stations are to be used.

The components which are adjusted during FM alignment are again visible in Fig.11. The FM oscillator is adjusted by the coil FM2 (2-1/2 turns, gold), and by the 'FM OSC' trimmer on the tuning capacitor (steps 2 and 3). Similarly the FM RF section tuning is adjusted using the FM3 coil just to the right of the capacitor, and the 'FM RF' trimmer on the capacitor (steps 5 and 6).

Note that coil FM2, as supplied, is wound tightly together. Once this coil is installed on the PCB, it can be adjusted by evenly spreading its windings apart. Do this with a non-metallic tool, so as to not damage the enamel of the wire. As the windings of the coil are separated further apart, its inductance is lowered, raising the oscillator frequency.

Again the point to remember during the FM alignment is that the **coils** are adjusted for the bottom end tuning, and the **trimmers** for the top end tuning. Here are the steps in detail:

Step 1: Start by creating a gap of 2mm between each of the turns of coil FM2. Also adjust the 'FM OSC' trimmer of the tuning capacitor to its half-way point, if you haven't already done so. Now switch the band switch to 'FM', and check that you can receive some FM stations.

Continued from page 29

turned off totally in retaliation, or simply because there's no money left to keep them going. That would be very sad.

If the METEORs do disappear completely, we still have the use of the American NOAAs 9, 10, 11, and 12 — which are bravely soldiering on, despite such problems as wobbly scan mirrors, pooped-out thrusters, and general old age. These satellites are only de-activated when two are physically close together, so that their radio signals are likely to interfere with each other. In this case the lower numbered of the pair is turned off until they drift apart again.

Amiga tracking program

At last! After searching all over the world, I've finally found an Amiga program for working out pass times for the polar orbiter satellites. The program, called *SatTrack*, is much like the IBM program with the reverse name: *TrackSat*.

The program is available on some computer bulletin boards, but only as a demonstration version. It has been 'crippled' so that its accuracy is out of whack, but there's still enough there for you to assess. If you think it will be useful, you must send a US$20 fee to *SatTrack*'s author, who will then supply you with a 'key' to properly enable the program's features.

If you can't find *SatTrack* on the bulletin boards, we can send you a disk with the compressed .LZH file on it for $10 posted, which is a copy and postage fee only. Order from the address below.

Kits & upgrades

As mentioned above, all Listening Post WESAT kits are now being supplied with the enhanced software features. Kit versions now come as CGA/EGA/VGA, or Amiga.

When ordering please remember to state which version you require, and for IBM, the disk size. The complete WESAT kit with software still costs only $99.00 posted to Australia or New Zealand. Money orders or cheques only please, in Australian dollars. We do not yet have credit card facilities — maybe soon!

Existing WESAT owners can upgrade easily; simply order a WESAT upgrade disk for either IBM or Amiga, stating disk size. The cost is $20.00 posted. The address, for kits or upgrades, is: High-Tech Tasmania, 39 Pillinger Drive, Fern Tree, Tasmania 7054. Telephone (002) 39-1391. ❖

Step 2: Tune in your selected 'bottom' (lowest frequency) FM station, and note the dial reading in MHz. If the pointer is *below* the actual frequency of the station, then squeeze the turns of coil FM2 slightly closer together. This will lower the receive frequency, and you'll find the station 'moves' up towards its correct dial position.

If the point is *above* the correct setting for the station, then the turns of coil FM2 should be separated slightly further apart. This will raise the receive frequency, moving the tuning point for the station further down the dial.

You should be able to achieve tuning of the station at the correct point on the dial, by the appropriate adjustments of coil FM2.

Step 3: Now tune in the 'top' (highest frequency) FM station, and as before note the dial reading in MHz. If the pointer is *above* the actual frequency of the station, then the 'FM OSC' trimmer should be adjusted for less capacitance — i.e., the plates less enmeshed. This raises the oscillator frequency, 'moving' the station tuning down the dial.

If the pointer is *below* the actual frequency of the station, then the trimmer should be adjusted for more capacitance (the plates enmeshed slightly more). This lowers the oscillator frequency, and moves the station tuning up the dial.

Step 4: Repeat steps 2 and 3 until the two stations can be tuned in at their correct frequencies on the dial. Don't forget that only coil FM2 is used for the bottom end station, and only the FM OSC trimmer for the top station.

Step 5: Now tune the radio to the bottom FM station again, and adjust coil the FM RF coil (just to the right of the tuning capacitor) to get best reception.

Step 6: Now tune to the top FM station, and this time adjust the 'FM RF' trimmer to get best reception.

Step 7: Repeat steps 5 and 6 until you are satisfied the reception cannot be further improved. This completes the FM alignment, and you should now be ready for finally assembly of your radio.

Final assembly

Before fitting the case halves together, do a final check inside the radio. The PCB should not foul on anything when the case halves are brought together, and this also applied to the wiring. This can be tidied up if necessary with a small amount of sticky tape, to ensure that none of the wires will be pinched by the case halves when they are brought together.

The two short metal rods (26mm long) used to secure the carrying strap should now be fitted in the lug holes on each side. The case halves will hold these rods in place once the case screws are tightened up.

The carry strap itself can be fitted later. With the carry strap rods in place, and the main case gasket fitted around the edge between them, the two halves of the case can be screwed together with the five remaining self-tapping screws (10mm long).

Check that the radio is operating correctly and does not need trouble-shooting, before inserting the five plastic screw plugs into the case screw holes. Finally, see Fig.12 for details of the way the carry strap is fitted, to ensure that the buckles secure the strap to the rods at each end of the case.

Troubleshooting

If you've followed the instructions carefully, your radio should work without any problems. However in the unlikely event that the radio doesn't work, here are some things to check:

Check the wiring between the PCB and the other components. Make sure that none of the wires has broken off and needs resoldering. If the radio has not worked from the start, then double check each wire against the wiring diagram. Also check that you've inserted the batteries with the correct polarity.

Check that the components have been inserted in their correct places on the PCB, and with their correct orientation. Perhaps a component lead has missed the correct PCB hole and gone into another one, by accident.

Check your soldering under the PCB. Soldering can often cause problems, particularly if an unsatisfactory soldering iron is used. One of your soldered joints may be too large, and touching another pad of the PCB; or alternatively the solder may not have bonded correctly to either the component lead or the pad on the PCB, so they are not really connected electrically.

A close visual inspection can usually locate these type of problems. If a joint looks suspicious, try re-making it with a hot iron — perhaps scraping any dirt, oxide or paint off the lead or pad, if necessary, to ensure that the solder can bond.

If you follow these simple steps, it's almost certain that you'll be able to get your radio going.

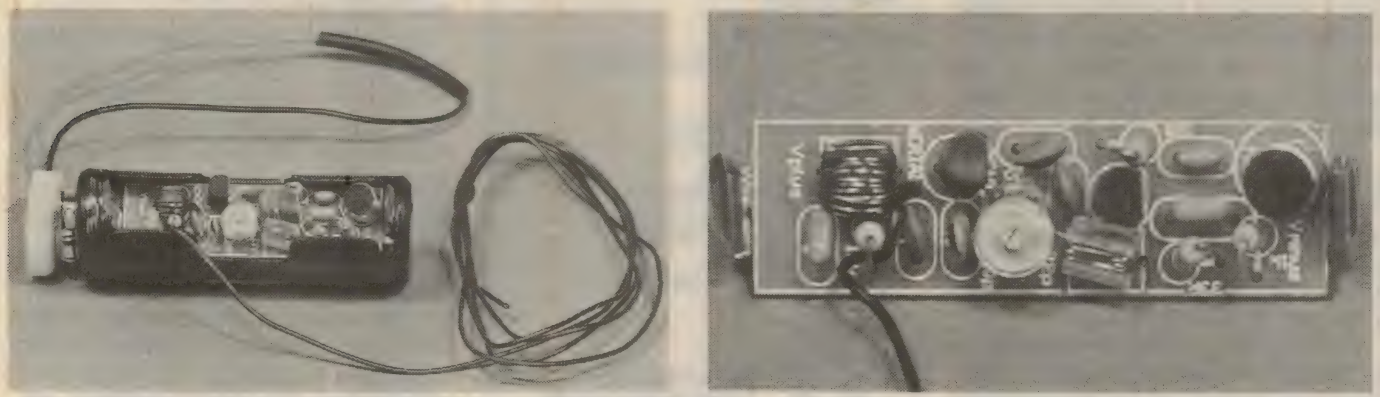
Congratulations — you've just built a complete AM/FM radio, and hopefully learned quite a lot about electronics in the process. ❖

Experimenting with Electronics

by PETER MURTAGH

Compact FM transmitter

This month's project is an extremely compact FM transmitter, with a range of around 100m, and a cost of only $11! A complete kit of parts to build this very stable design is available from Oatley Electronics, and all you have to provide is one AA 1.5V battery to power it.



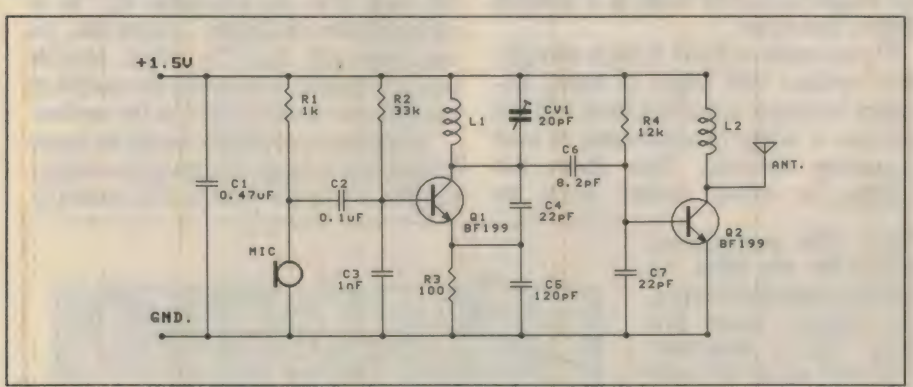
Left: The compact design of the transmitter allows the PCB to be inserted in the top channel of a twin AA battery holder (the single battery required is in the bottom channel). The overall length of the unit is only 65mm. Right: The board makes electrical contact with the battery via the two end clips, which are made by cutting a fuse holder in half, and soldering them to the copper track.

Even though we designed our own two-transistor FM transmitter back in May 1992, we were very impressed with this Oatley Electronics unit — especially with its very compact design. The single battery required (which needs to supply only about 5mA) fits in one half of a twin AA battery holder, and the PCB with its components fits in the other. That's how compact it is!

The unit has very good frequency stability, which is achieved by having good isolation between the oscillator stage and the antenna (more on this later). It also has high audio sensitivity, partly because of the high output of the miniature electret microphone. In fact, you can easily overload the transmitter by speaking directly into the mic.

As with any such FM transmitter, you need a corresponding receiver — so any FM radio can be pressed into service. By adjusting the trimmer capacitor CV1 on the board, we were able to receive the transmitted signal on our radio anywhere from 88MHz to 104MHz — almost the full 88 - 108MHz FM radio range.

Note that the two transistors used in this circuit are not our usual BC548s, but rather BF199s. This particular transistor is designed especially for high frequency amplification, so it is especially suited for transmissions around 100MHz. By referring to Fig.2, you can see that the BF199 pinout is different to that of the BC548. This of course does not present any problem for the constructor, as you merely insert the transistor leads into the relevant pads on the PCB.



The schematic shows the two sections of the receiver circuit: on the left is the tank circuit whose frequency is modulated by audio signals at the base of transistor Q1; while on the right is transistor Q2, which acts as a buffer to isolate the aerial from the main circuit, improving stability.

Construction

Start by cutting the fuse clip in half, using a pair of side cutters. This will give you two L-shapes which you will use as the two 'power terminals' for the PCB. Position them as shown in Fig.3, and solder them to the two strips of track provided at the ends of the PCB.

Next wind the two RF coils on the two small plastic formers. Fig.2 shows how this wiring is done. Cut a 60mm length of the enamelled copper wire to make

coil L1. Pass the wire down the centre hole, and back over the top, until you have three wires visible on the top surface, wound close together.

The 'in' and 'out' wires will be at opposite ends of the former, giving you the 3.5 turns required. Scrape off the enamel from the ends of the wire, and solder them to the PCB. Keep the wires tight, and the coil snug up against the board.

Repeat the same wiring pattern for coil L2, but this time make 20.5 turns. About 300mm of wire will be needed. Unlike the first coil, the turns on this one will cover the whole surface of the former. Again, solder the wires to hold the coil in position.

Finally, solder in the rest of the components, taking extra care with your soldering since the pads on the PCB are closer together than our normal designs. Use a sharp, clean soldering tip. Remember to attach the 800mm length of hookup wire for the aerial.

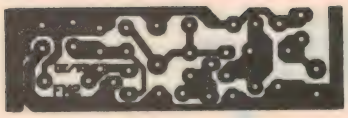
With all the components soldered to the board, it's time to mount it in the battery holder. One channel of the holder is used for the battery, the other for the PCB, and its external contacts for the switch. The 'switch' is just a 9V battery snap, with its two contacts wired together. To switch on, you push the snap over the battery holder contacts — and to switch off, you simply remove it.

To avoid any confusion with our instructions, place the 1.5V AA battery in the channel of the holder that has the (negative) spring clip at the switch end. Insert the battery with the correct polarity, as marked on the plastic casing. However, because the holder is designed for two batteries *in series* — and we want one battery *in parallel* with our PCB — the polarity markings on the second channel will be backwards. So the positive end of the PCB, marked 'Vplus' presses against the second spring clip (marked '-'), and the 'Vminus' (microphone) end is next to the switch ('+').

Since you probably won't remove the PCB again, it is far better to have the battery follow the correct polarity marking on the holder, rather than the PCB. This way you can just follow the standard polarity markings, when you come to change the battery.

Setup

Once construction is complete, it's time to adjust trimmer capacitor CV1, to select your transmitting frequency. Find



If you wish to etch your own board, then make use of this full size PCB pattern. However, for just $11 you can get a full kit of parts from Oatley Electronics, including the board.

a spot on the radio dial where there is no FM station broadcasting, and turn up the volume so that there is a reasonable amount of background noise. Slowly adjust CV1 (a clockwise rotation increases the frequency) until there is a distinct drop in that noise.

If your radio volume is high enough, your speaker will begin to howl, because its output is feeding back into the mic and is being re-transmitted at ever increasing intensity. Turn down the volume, or move further away, to remove this feedback, then start speaking into the mic. Fine tune the radio dial, rather than trimmer CV1, until you can hear yourself, nice and clearly. The unit is now ready to use.

PARTS LIST

Miscellaneous

PCB 45 x 13mm, coded OE/93 FM2
1 AA 1.5V battery
1 9V battery snap
1 twin AA battery holder
1 high output electret mic.
2 plastic coil formers (5mm long, 5mm diameter)
360mm enamelled copper wire (0.4mm diameter, B&S 26)
1 fuse clip (see text)
800mm hookup wire (aerial)
solder, etc.

Resistors

All 1/4W, 5%

1	1k	R1	brown-black-red
1	33k	R2	orange-orange-orange
1	100	R3	brown-black-brown
1	12k	R4	brown-red-orange

Capacitors monolithic ceramic

1	0.47uF	C1
1	0.1uF	C2
1	1nF	C3

Capacitors ceramic

1	22pF	C4
1	120pF	C5
1	8.2pF	C6
1	22pF	C7

Trimmer capacitor

1 20pF CV1

Semiconductors

2 BF199 NPN transistors Q1,Q2

Changes

If you find that the transmitter is too sensitive, so that you have to speak across the microphone rather than directly into it, you can reduce its sensitivity by reducing the value of the 1k mic load resistor R1.

Of course, you could also try increasing it to make the unit more sensitive, but you will probably end up with too much distortion.

The other change that you could make is to vary the number of turns on wire on the coil L1. This determines the oscillator frequency. Removing 0.5 or 1 turn will increase the frequency, or adding turns will reduce it.

How it works

Because the electret microphone insert used in this circuit has a very high output, the signal does not need any further audio amplification. The output of the mic is sent via capacitor C2 to the base of transistor Q1, which performs two functions: keeping the tank circuit oscillating and allowing the modulation of its resonant frequency.

The principal components which make up the tank circuit are inductor L1 and trimmer capacitor CV1. The energy in this circuit is alternately stored in the inductor and the capacitor, as the signal oscillates back and forth between them (for more details on its operation, refer back to the May 1992 article).

Theoretically, this oscillation continues forever, but in practice it will die away, due both to energy losses in the various components, as well as the energy transmitted in the FM signal. Hence the first role of transistor Q1 is to replenish the oscillation. It does this, via capacitors C4 and C5, which provide positive feedback between the output at the collector and the input at the emitter.

This positive feedback works by transferring any voltage change at the collector directly to the emitter. For example,

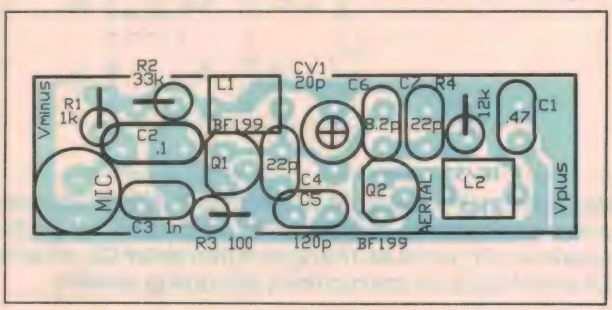


Fig.1: The component layout for the PCB. To get the compact design, the various pads are fairly close together. You will need to take care when soldering not to bridge these pads. Note that the BF199 transistors used are special HF ones.

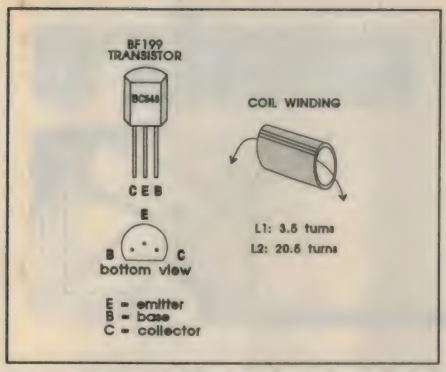


Fig.2: This diagram shows the pinout on the BF199, which is different to the BC548/558s which we normally use. It also shows how to wind the 3.5 turns on RF coil L1 (and 20.5 turns on L2).

if the voltage at the collector rises, then so too does that at the emitter; the base-emitter voltage then drops, turning off the transistor. As the transistor turns off, the collector voltage will rise — so the original rise in the collector voltage receives positive feedback.

However, the whole output signal is not fed back in this way — capacitors C4 and C5 form a capacitive divider. Because the impedance of each is inversely proportional to its capacitance, only a small fraction of the signal is fed back (about 15%).

The second role of transistor Q1 is to modulate the frequency of the tank circuit. It does this because the audio input changes the base-emitter capacitance of the transistor — and the frequency of the tank circuit depends not just on the value of trimmer capacitor CV1, but also on all other capacitances involved. Hence small changes in the audio signal input level result in small changes in the output frequency.

The second transistor Q2 is really only a buffer. Its role is to isolate the tank circuit from the antenna, which helps the frequency stability. Without it, moving the position of the antenna wire will alter the broadcasting frequency considerably.

This isolation is further improved by the use of another capacitive divider, C6 and C7. Because only a fraction of the signal is applied to the base of transistor Q2, any feedback in the opposite direction is also proportionally reduced.

Transmitter kit

As mentioned earlier, the complete kit of parts, including the battery holder, is available for just $11 from Oatley Electronics. Only the AA battery is not supplied. If you want three kits, the cost is $30. Postage for any number of kits is an additional $3. (For information on how to obtain this and other kits, see Oatley Electonics' ad on the inside back cover of this issue.)

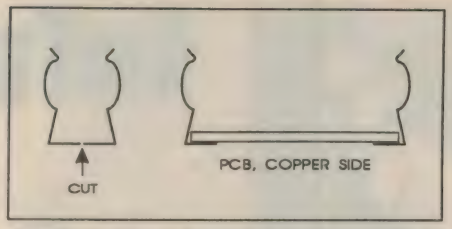


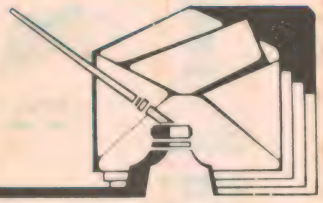
Fig.3: Cut the fuse holder bracket in half, and solder the pieces to the PCB as shown. These make electrical contact with the fittings in the battery holder.

Transparencies

As usual, a high contrast, actual size transparency (negative) for the PCB used in this circuit is available for only $2. This will allow you to etch your own printed circuit board, if you do not wish to buy the Oatley kit. This special price applies for transparencies for all projects in this series only. Write to *EA*'s reader services division.

Happy experimenting — and please send us your comments on the circuits we have published, as well as ideas for future projects. ❖

Information centre



Conducted by Peter Phillips

Electric shocks, Harris transmitters and more

This month a reader gives us a few 'bottom lines' about the effects of an electric current, and we get into a range of other topics — including how sidebands are generated in an AM transmitter, how much an electronics technician gets paid and a bit more about what kinds of projects we should have in the magazine.

I've always been interested in the phenomenon surrounding an electric shock, and more particularly in what represents a 'safe' electric current. As an apprentice I took part in a bizarre experiment concerning a bush rat and a variable AC supply. The rat won, by the way.

If you think that's cruelty, then what about the apprentices who connected *me* in series with a set of 240V test lamps and the mains. I was sharpening a drill at the time, and my ears were used to complete the circuit. I can still recall the effect — talk about seeing stars!

Over the years I've had my share of electric shocks, and I doubt I'll ever get used to it. In fact, I'm downright scared of electricity and I haven't regretted the advent of solid-state electronics with its attendant low voltage supplies.

But am I being unnecessarily scared? For instance in my description of the solid-state megger (*EA* July 93) I made the point several times about being careful with the project. But as a reader pointed out last month, there really is nothing to worry about. So what is a lethal current? What are the facts?

Our opening letter briefly explains. It's written by Brian Byrne (Indooroopilly Qld), who originally wrote about the relative safety of the megger. Brian is not without qualifications in this area, and I'm condensing (considerably) a paper he produced for a series of Standards Seminars in 1992. Brian also worked on the development of AS 3859 (Effects of Electric Current on the Human Body) and his paper draws from these Standards.

Research over the last decade has involved many electrical tests on live animals, notably dogs, sheep and pigs which have the nearest equivalence to human body weight and cardiovascular activity. It has also involved the testing of some hundreds of volunteers, at voltages around 15-25V RMS, to determine 'let-go' threshold and average body impedance.

Other measurements have been made on recently deceased human bodies. Finally, spectacular and no doubt painful measurements of dangerous currents have been made on a few volunteers, with RCD protection and of course, defibrillation equipment.

Muscles are controlled by a neural, or nerve system that is somewhat similar to a telecommunication system. The command to a muscle to contract or relax is with a tiny current flowing through the nerve fibres, caused by a few millivolts of potential.

Any system that depends on electric currents needs to have the conductors insulated, and the neural system is no exception. But if a high enough voltage is applied externally, the insulation will break down and a leakage current from the external source will take over control of the system.

The interference caused by the external current will depend on the value of the current, the shape (AC or DC) and the path taken by the current as it passes through the body.

A measured and statistically quantified 50Hz (and 60Hz) hierachy of effects has been produced by various researchers, which are:

1. *Threshold of perception, which is the first sensation of the presence of current as the value is increased from zero. It depends on a number of factors such as electrode contact area,*

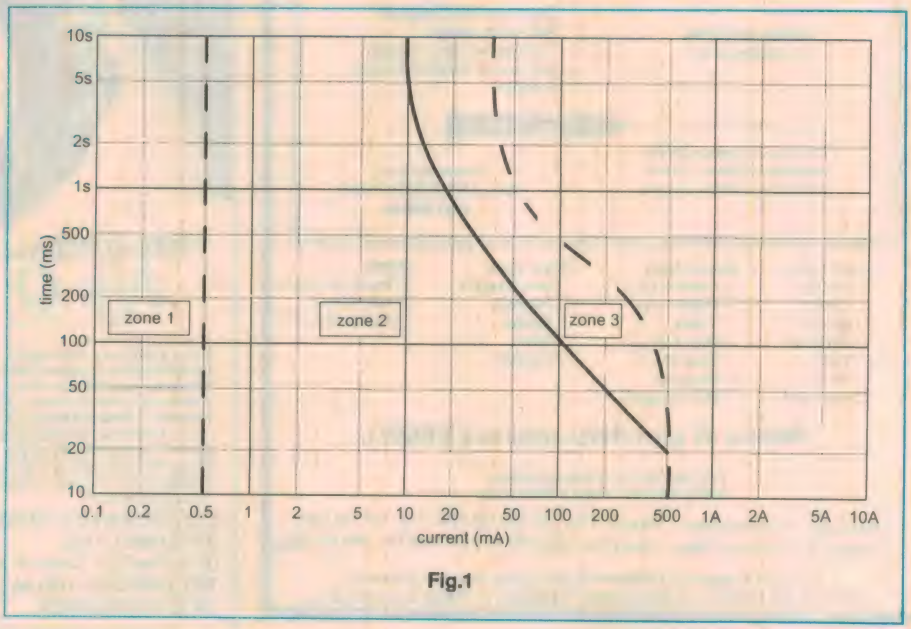


Fig.1

moisture, temperature and individual physiology. It is not a painful condition and a broad average is a current of 0.5mA.

2. *Threshold of 'let go'. Like 1 above, it depends on several factors. Beyond this threshold the normal neuromuscular signals are overwhelmed by the interfering current and the individual loses the ability to release contact with the live conductor. A typical current is 10mA, and although associated with some muscular pain, it is of otherwise limited concern.*
3. *Threshold of ventricular fibrillation. Ventricular fibrillation is a most serious condition and is the main reason for death due to electrocution. The threshold is not a specific electric current but rather a range of current and time combinations. These depend on physiological parameters (such as state of the victim's heart) as well as on electrical parameters (duration and path of current).*

The graph of Fig.1 shows the current/time relationship for an AC current flowing from the left hand to both feet (usual path). In zone 1, there are no reaction effects and in zone 2, there are usually no harmful physiological effects. Current values to the left of the dashed curve are unlikely to cause fibrillation.

However, current values to the right of the dashed curve are increasingly likely to cause fibrillation. For instance, the briefest exposure to 500mA is likely to cause this effect, while at 30mA, continuous exposure is unlikely to result in fibrillation, though it will be very painful and let-go failure may cause fatal secondary effects.

Similar work on direct current has resulted in a set of curves like those in Fig.1, except the threshold of perception is about four times higher (2mA) and the ability to let go is less distinct (specially for high current/short duration shocks). More significantly, for a shock lasting one second or more, the current likely to cause fibrillation is around four times higher than for AC.

The resistance of the body is one factor that determines the value of an electric shock current. A substantial number of measurements has shown that the average resistance (ignoring skin resistance) of an arm or a leg is around 500 ohms, as shown in Fig.2.

This resistance is due to the salinity of the blood, which is 0.6%, giving a resistivity of about one quarter that of sea water. So short large diameter blood vessels, such as those linking the cardiac area to the lungs and brain are of negligible resistance compared to the arms and legs.

But obviously skin resistance needs to be considered. Research has established several significant facts. For voltages over about 200V, the skin breaks down and the body resistance equates to the blood path figures shown in Fig.2. As well, most people have the blood resistance figures of Fig.2. Importantly, 50V RMS has not been proven to be hazardous, mainly because of the resistance of the skin. However, 110V 60Hz has resulted in a significant number of fatalities.

There are a few additional points worth noting, for both AC and DC. For a high current level lasting less than 100ms, fibrillation may occur for magnitudes above 500mA and is likely to occur for currents of several amperes, but only if the shock falls within the vulnerable period. For shocks of such intensities and durations longer than one cardiac cycle, cardiac arrest may be caused, which might be reversed after the removal of the current.

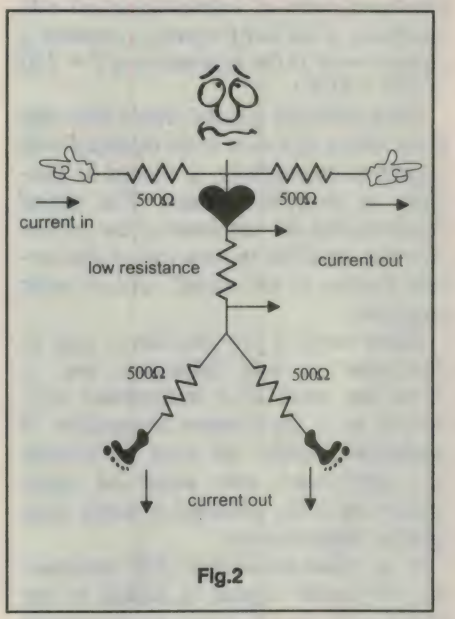


Fig.2

Though ventricular fibrillation is the major cause of death by electric shock, there are a few other effects that can be fatal. Muscular contractions, asphyxia, rise in blood pressure, failure of heart impulses, including atrial fibrillation, and 'transient' cardiac arrest can occur without ventricular fibrillation. Such effects are often reversible and therefore not necessary fatal.

In conclusion, the electro-physiological make-up of the human body is far from being a simple electrically sensitive system. Nevertheless, the vast amount of research carried out has yielded a workable set of body-current relationships that can be used with a margin of safety to predict acceptable electrical and time combinations for the design of protection equipment.

Three bottom-line conditions are worth recording:

1. *Voltages below 50V (50Hz) are relatively safe.*
2. *The average resistance (with appropriate variations for environment) of a human body is around 1000 ohms. This decreases with duration of the current and with body parts that are shorter than that from extremity to extremity.*
3. *The maximum 'safe' current tolerable for one second is 50mA. However this value is less for longer periods or if it passes through more crucial body parts.*

Thank you for this interesting summary, Brian. I'm sure readers will appreciate such an in-depth look at the effects of an electric current. I trust this cut-down version of your excellent paper hasn't left out too much, and that I've encapsulated the main points.

It's interesting to note that the 'let-go' effect is worse for AC than DC. I always thought the reverse was the case, where the periodic reversal of an AC current allowed the muscles to respond more readily to neural commands. Perhaps Edison was right after all!

And now back to the project that prompted the foregoing...

Megger revisited

The July 93 Megger is proving very popular with constructors, and the next letter is from a reader who has just built one.

This is a letter of appreciation, but also I want to pass on some information concerning the megger described in July. My son, (an electrical contractor) asked me to build the megger kit he purchased from Oatley Electronics.

Firstly, Oatley Electronics were most helpful in their supply of the kit and included BUZ71 MOSFETS in lieu of the cheaper MTP3055 types specified in the circuit. The unit worked perfectly after I corrected a transformer wiring error (I wired the primary of the transformer to the PCB rather than the secondary). However, there are two minor things I want to point out.

The first is that the silk-screen on the PCB supplied by Oatley Electronics showed C1 as 0.0022uF and a 2.2nF capacitor was supplied. The correct value is 0.022uF (or 22nF). Secondly, the battery holder supplied had holes in the rivets for the positive end that were so

large the battery terminals didn't make contact.

To fix this, I soldered 1/8" washers to the rivets. However, despite these two minor problems, the unit works very well, and I've adjusted its output to 520V (rather than the recommended 500V) across a 1M load.

Another modification I did was to alter the LO ohms scale to give a centre-scale reading of about 2.8 ohms. This obviously required the meter scale to be modified as well. To do this I changed R10 to 56 ohm, made R11 a short-circuit and used a 5.6 ohm value for R12. (R.G., Wollongong NSW).

Another satisfied customer, it seems. I'll pass your comments onto Oatley Electronics R.G., as they are always grateful for this sort of feedback. Changing the LO ohms scale seems fair enough, as the required 2.0 ohm point should ideally be somewhere in the centre of the scale.

S-video converter

The next letter suggests a project that I think would interest a growing band of readers...

May I request a project for people with high quality video monitors. I would like to build a Y/C or S-video to RGB converter.

I have seen this already in an overseas journal, but had no reply from the French kit supplier. A number of imported colour monitors have a Scart connector which has connections for an RGB input. The main ICs for the project are less than $15 each. (R.S., Alfred Cove WA).

These days quite a few video cameras as well as VCRs have an S-video output and I'm told the picture quality is much improved with this system if the monitor has the right kind of input. Unfortunately you didn't include a copy of the article you refer to, so we aren't really in a position to comment on the viability of such a project. However, if dedicated ICs are available, it would seem a simple enough task. Perhaps you could get back to us with more information, R.S.

Harris AM transmitter

In the August issue I included a question about the Harris modulating system. The next letter is about this question and includes a bit of general discussion on the matter...

In answer to your question, sidebands are produced whenever the amplitude of the carrier is changed. It doesn't matter what method you use.

In 'conventional' amplitude modulation, the carrier is multiplied by (not mixed with) the audio signal. When two 'sinewave' signals are multiplied together the result is given by the equation cosA.cosB = 1/2[cos(A+B) + cos(A-B)]. That is, it produces the sum and difference frequencies with half the power going into each sideband.

In the early days of radio communication, ICW was used for transmitting Morse signals, where ICW stands for Interrupted Continuous Wave. The carrier was generated continuously and the Morse key was inserted in the lead to the aerial.

Sending a series of 'dots' was equivalent to 100% modulation by a square wave at the dot frequency. This produced pairs of sidebands at all odd multiples of the dot frequency, because a square wave is the equivalent of f + 1/3f + 1/5f + 1/7f + ...

Then someone got the bright idea that if the Morse key were to be replaced with a carbon microphone, it should be possible to transmit speech. The sound waves varied the resistance of the carbon element, and this in turn varied the current flowing to the aerial. And so radio was born.

There were a few problems, and in particular it was important not to stand too close to a microphone connected to a high-power transmitter. It probably couldn't be used by present day performers who insist on swallowing the mike, although it might liven up their performance!

In a plate-modulated AM transmitter, the audio signal is added to (or mixed with) the DC supply to the plate of the final power amplifier stage. At 100% modulation, the plate voltage swings from zero to twice the steady-state value, so varying the power generated and hence the amplitude of the modulated signal.

In the Harris digital transmitting system, it appears that power amplifying units are switched in and out as needed to vary the power generated, and hence the amplitude of the modulated signal. The result is the same, and the same sidebands are produced by either method for the same input signal. You might like to think about the first radio transmitter using a carbon microphone in the aerial lead where there wasn't any audio signal, yet it still produced the same sidebands.

I'm interested in the efficiency figure of 85% quoted for the Harris digital transmitting system. Is this the overall efficiency of the transmitter (that is 50Hz power in to RF power out) or is it the efficiency of the output stage, or DC power in to RF out? It's a very good performance if it's the first!

I installed a number of 10kW and 50kW MF transmitters in the late 50's and early 60's that had an overall efficiency of better than 50%. The efficiency of the final class C stage was 92%, compared to a theoretical efficiency of 67%.

This increase in efficiency was achieved by a simple and cheap modification in which an extra coil was added between the plate and the output tuning circuit. The coil and its self and stray capacitance was tuned to either the fifth or seventh harmonic of the operating frequency, giving a waveform at the plate that was more like a square wave, with very much shorter rise and fall times, and hence much reduced losses.

As a suggestion, a technical article on the Harris digital modulation system would make interesting reading. (A.F., Balwyn Vic).

The efficiency of 85% is for 50Hz power in to RF power out, which by any measure is good. That is the main benefit of the system (as far as I know), as it substantially reduces the operating cost of a radio station.

I agree an article on the Harris system would probably interest a lot of readers, but unfortunately it's rather difficult to get much information. There are not many of these in use, although one would think the system would be an attractive replacement for an old transmitter. If anyone can send me some information on the Harris system, I'd be most happy to present it in these columns.

Content comments

In August I devoted a part of Information Centre to reader comments about the content of the magazine. This has resulted in a few more comments...

I believe your test equipment projects, spectrum analyser, and inductance adaptor projects are excellent as they are not only educational to build, they are cheaper than buying the actual device. In fact where possible, this should be the basis for all projects.

I think many readers (including myself) would like to see some comprehensive articles with circuit diagrams about the operation, repair and likely problems of domestic/commercial equipment such as fax machines, microwave ovens, refrigerators, washing machines and air conditioners.

Perhaps EA could also set aside space for tips from readers, such as how to recycle common household items. For in-

stance, empty Biro tubes and tubes from spray bottles can be cut into small pieces for PCB spacers. An empty syringe makes a great grease dispenser and plastic diskette boxes are good as project cases.

[Changing the subject] *I read about a situation vacant position in August in the 'Market Place' section. The advertiser wants a well qualified technician with a great deal of experience, for $418 per week. It hardly seems worth getting qualified, if that's all you get paid!* (D.C. Narangba Qld).

Taking each point in turn D.C., I agree that the ideal project is one that is not only useful, but cheaper than a commercial model. Unfortunately, the gap is closing and finding such projects is becoming increasingly difficult. Test equipment is still an area that meets this criterion.

I also agree that readers like articles describing the operation of various items of electronic/electrical equipment. Over the years we have presented quite a lot articles about such equipment. However, we tend to stop short of describing refrigerators, air conditioners and washing machines, due mainly to their high mechanical component. Somehow the description of a fridge doesn't sit nicely in an electronics magazine.

Still, given that in many cases (particularly VCRs) the fault is mechanical, perhaps we should consider broadening our horizons to include other types of equipment like those you mention.

Regarding a space for reader hints, regular readers will know that Information Centre serves this function and we've had quite a lot of useful hints over the years. For instance, spraying a dot matrix printer ribbon with WD40 to rejuvenate the ribbon.

Articles about recycling and hints on ratting old TVs etc., are occasionally offered to us. We haven't published such an article so far as we are not sure whether readers are interested. After all, most of us are 'ratters' from way back, and masters of invention when the need arises.

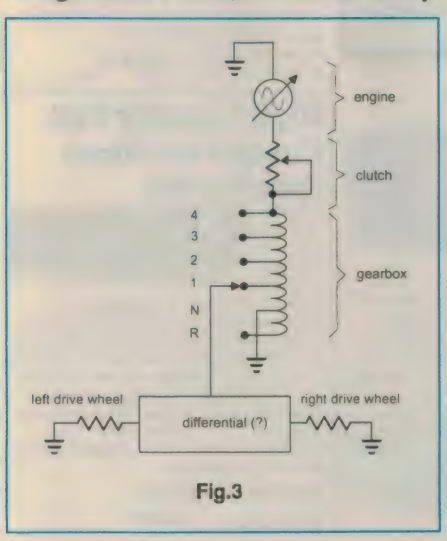


Fig.3

Finally, while I agree $418/week is lousy pay for a qualified technician, this is not far from the usual award rate. Certainly if money is your main reason for deciding employment, electronics might not be the best choice. But the award rate for most other trades is similar, although the multiskilled electricians at ICI's Botany plant are doing rather better at around $70,000 pa.

In other words, there are also jobs that offer more than the award rate. Most employers value a talented technician and will offer above-award rates once they're convinced the technician is worth it. So don't despair, D.C.

Here's another letter with a few more comments about the magazine content.

How many readers actually build the projects described in EA? I wonder if many readers are like me, where I build only a few projects but enjoy reading the articles describing them. To me EA is a source of relatively painless learning covering a fairly wide field.

I found the articles by Jim Rowe describing the direct digital synthesiser most informative and I much appreciate the historical articles appearing lately. The series on Australian radar sets by Colin Mackinnon has filled a gap in my knowledge and I always look forward to tales from the Serviceman. I also enjoy reading Forum and Information Centre (Thank you, P.P.). *In fact, I even find time to read those sometimes outrageous comments of Tom Moffat. I look forward to reading EA for some years to come.* (R.H., Killara NSW).

I think you are very typical of the readership, R.H. As you say, sometimes the article explaining the project is more interesting than the project itself. And from your comments, it seems you're basically happy with the content. I think most readers would agree with you, as those who don't read EA are obviously not interested in what we offer. But how do we find out what *they* want?

What??

The question this month is rather different and comes from Graham Leadbeater, who has sent us some good questions in the past. Remember the pi ohms problem? (Just to remind you, I'm getting very low on suitable questions for this part, so if you have anything you think other readers will enjoy puzzling over, please send it in.) Graham writes:

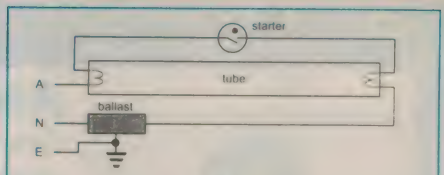


Fig.4

This one is for the mechanics. The diagram of Fig.3 is an electrical representation of a car's transmission system, where the engine is a variable-voltage alternator, the clutch is a resistance that can be varied from a short-circuit to an open-circuit. The gearbox is a tapped auto-transformer.

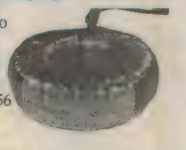
The question is, what's in the 'differential' box?

Answer to October's What:

The circuit of a fluorescent light is shown in Fig.4. This is the conventional arrangement found in light fittings, not the portable types that have featured from time to time in EA.

The reason for connecting the ballast (which is simply an iron-cored inductor) in the neutral is that if it develops a short to earth, the fault current will blow the filaments in the tube rather than the main fuse. This means you don't lose all the lights because one is faulty. ❖

45-0-45V Toroidal Transformers



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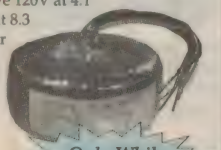

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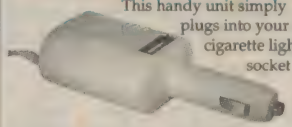

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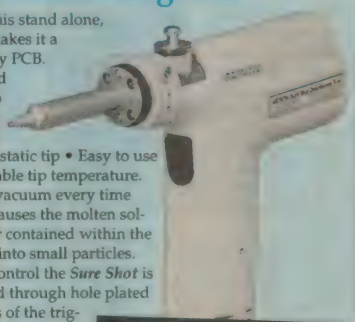

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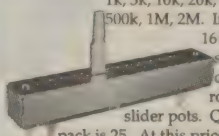

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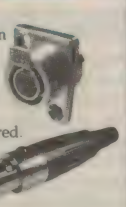
NEW



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Ideal for Those Miniature Audio Projects!

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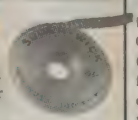

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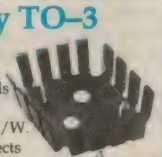

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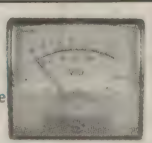

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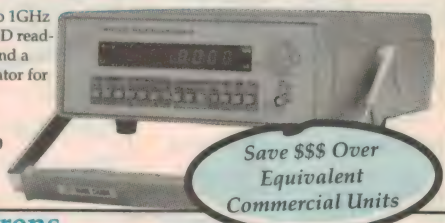

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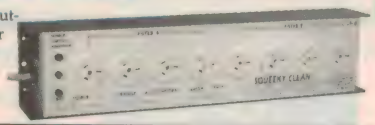

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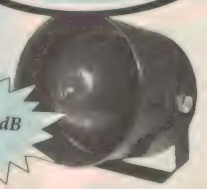

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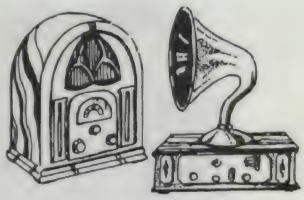
Vintage Radio

by PETER LANKSHEAR



Shortwave adaptors and converters

In the hunt for early equipment, the vintage radio enthusiast may come across a chassis, perhaps with a cabinet, that appears to be an incomplete receiver. Closer examination may reveal a tuning capacitor and RF coils, perhaps a power supply, but no audio section or loudspeaker. If so, the chances are that a shortwave adaptor or converter has been unearthed...

Shortwave adaptors or converters enabled standard broadcast radios to receive shortwave signals, and converters were often quite efficient. Some were made by receiver manufacturers during the early 1930's, but many more were assembled at home — often from kitsets. Radio magazines regularly published descriptions and construction information for them.

But what made converters so popular? Interest in shortwave listening grew alongside early broadcasting, but its origins go back to an International Telecommunications Conference held some 80 years ago. By 1912, the situation had become rather chaotic, and with the growing importance of radio for marine safety and revenue-earning commercial traffic, greater control was necessary.

Amateurs were fortunate not to be banned altogether, but rather their transmitting power was limited and they were banished to the region above 1.5MHz — where the restricted range of transmission was expected to render them 'harmless'.

There were valid engineering reasons for this decision. It was known that reception conditions varied with time of day and seasonally, but the characteristics of the ionosphere were not understood, and all signal propagation was assumed to be by ground waves whose attenuation was considered to be proportional to the number of wavelengths traversed.

For a given radiated power and distance, the attenuation at 15kHz with a wavelength of 20 kilometres is only 1% that of a 200 metre, 1.5MHz transmission. With this sort of limitation, the assumption was that amateurs could play happily in their own immediate vicinities and not annoy the neighbours.

Unexpected 'DX'

World War I put a stop to all amateur activity, but provided the stimulus for considerable communications research and development. With the end of the war and the resumption of amateur transmitting, and now with access to valves, hams were confounding the experts by communicating over unexpectedly long distances.

As described in last April's column, by 1921 American amateur signals had crossed the Atlantic, to be received in Scotland by Paul Godley using a Beverage aerial. The ultimate low powered DX was achieved in October 1924 when, transmitting with a few watts, Frank Bell of New Zealand's North Otago held a

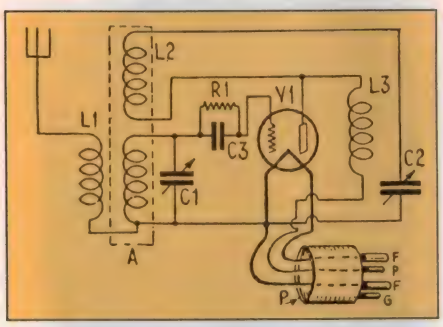


Fig.1 (above): The earliest 'add ons' for shortwave reception were simple regenerative grid-leak detector units plugged into the detector socket of a broadcast receiver. In this 1929 design, C2 is the regeneration control and L3 an RF choke.

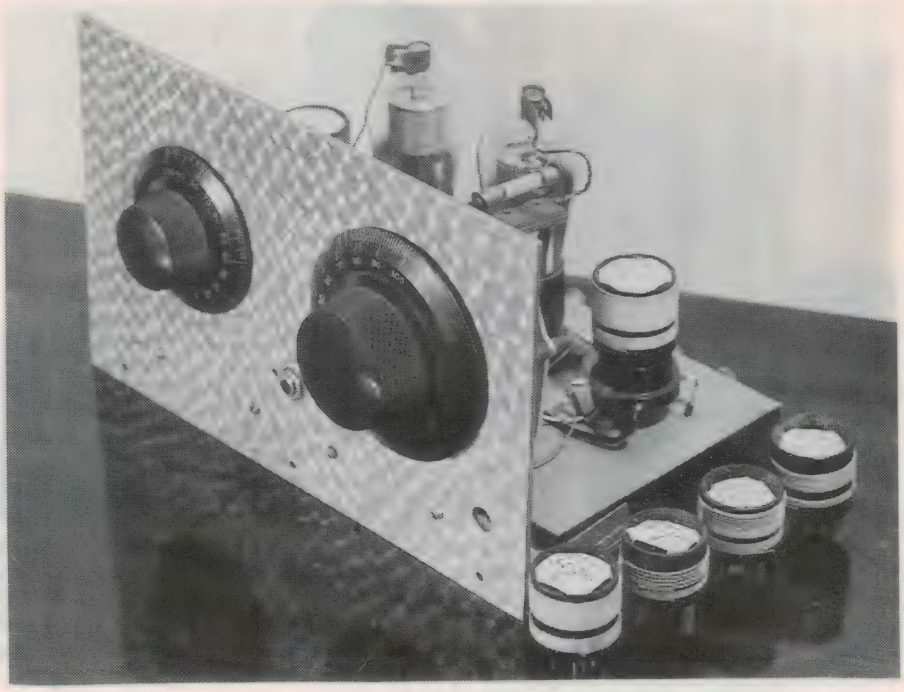
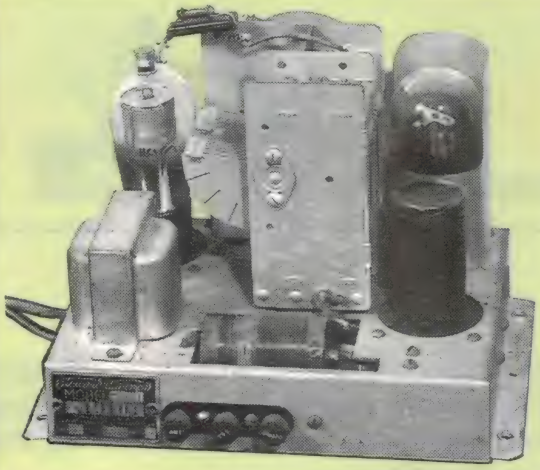


Fig.2 (right): Someone went to a lot of trouble building this neat little converter, found in a collection of early amateur equipment. The plug-in coils are wound on old valve bases.



Bandswitching is by means of an ingenious linking of toggle switches. For some reason, the type '24 grid-leak detector is connected as a triode. The converter has no IF transformer, and the main receiver can be tuned to any suitable frequency on the broadcast band. The variable grid inductance is to adjust tracking.

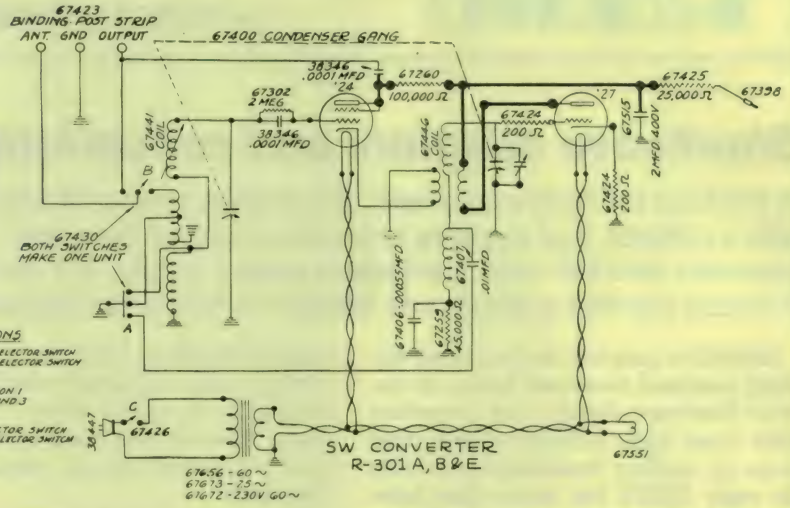


Fig.3: In 1931, Stewart Warner brought out its R301 converter, originally in a small pagoda-topped cabinet. The valve filaments are run from its own transformer.

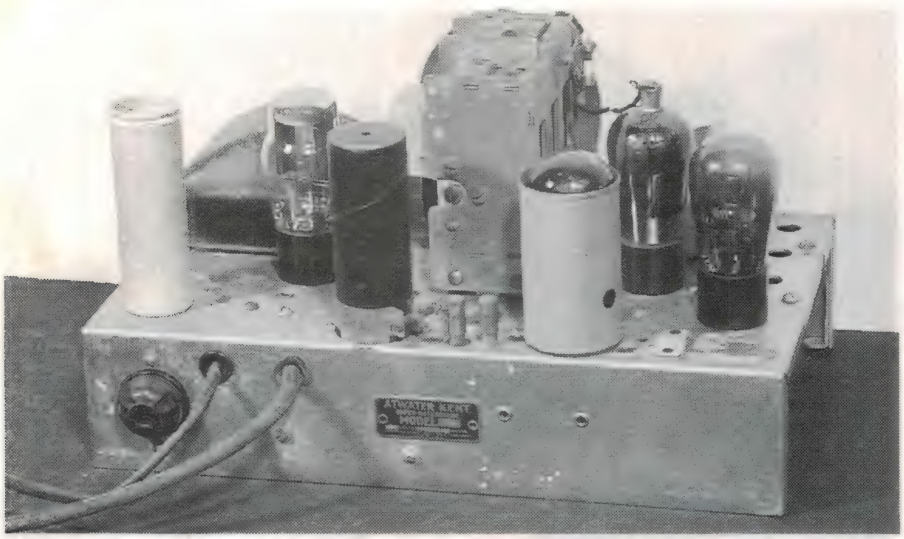
two-way 3.3MHz communication with Cecil Goyder in London.

Meanwhile, Marconi and his engineers had been doing their own research into shortwave transmissions. As has been related many times, one outcome of this was the abandonment of the proposal to build the enormously expensive long wave Imperial Wireless Scheme linking Britain with the Empire. Instead the much simpler and less costly shortwave Beam Wireless service was set up.

During the 1920's, all manner of interesting shortwave transmissions began to be heard. As well as increasing communications traffic, pioneer broadcast stations like America's KDKA were experimenting with using shortwave transmissions for linking. Others simultaneously transmitted their standard medium waveband programmes on shortwave, and by 1928, 3LO Melbourne and 2ME Sydney were broadcasting internationally on shortwave.

In a 1934 editorial in the American *Shortwave Craft* magazine, Hugo Gernsback commented on the already extensive use of shortwave radio by governments for propaganda broadcasting — which still occurs today, of course.

In the early days, the only practical shortwave receivers were the superheterodyne and the regenerative detector. The conventional TRF had insufficient selectivity and sensitivity. The selectivity of RF amplifiers is related to frequency, and a bandwidth of 1% would be a representative figure. At 1MHz this is 10kHz, typical for a domestic receiver.



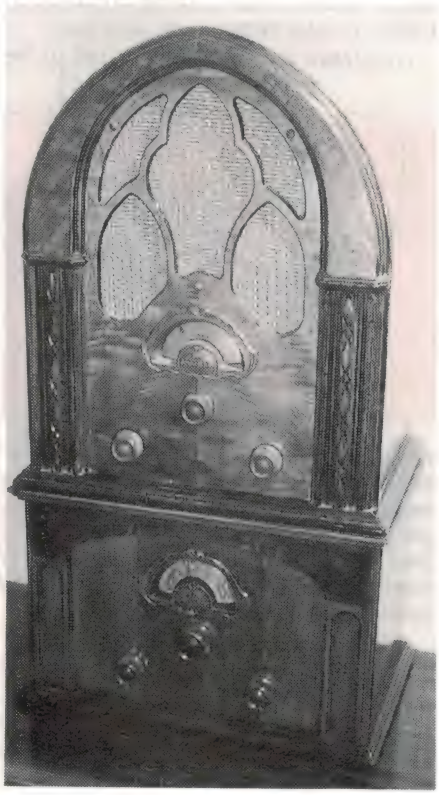


Fig.4: Far from being experimenter's inexpensive add-ons, some converters were very well made and intended to be integrated with the manufacturer's receivers. With its own power supply and an IF amplifier, and using the standard Atwater Kent nickel plated mantel receiver chassis, the self-contained four valve Atwater Kent 1932 three-band model 93 was as complex and cost as much as some complete receivers. It could be used as a stand for the model 567 (right).

However, this same percentage at 10MHz becomes 100kHz, which is far too wide to eliminate adjacent signals.

In any event, until the advent of the screen grid RF tetrode in 1927, there was no practical shortwave RF amplifier for receivers. Although the superheterodyne was eventually to be the ultimate method of reception, before 1930 there were patent restrictions, making it very expensive. Also existing technology was not very successful at shortwave frequencies. With the low frequency and broadly tuned IF amplifiers then in use, strong nearby transmissions could 'pull' the local oscillator frequency off tune. Selectivity was poor and there were too many spurious responses and images.

Although it was far from perfect, the regenerative detector did not have these problems. When well constructed and used properly, this type of receiver, coupled to a simple audio amplifier, provided sensitivity and selectivity out of all proportion to its simplicity, and some impressive DX reception was achieved.

Prior to the advent of screen grid RF valves, commercially made broadcast band receivers combining the functions of broadcast band and shortwave reception were uncommon. Even then, multiband receivers were enthusiasts' instruments with plug-in coils — a landmark example being the Pilot Super Wasp, featured in January 1990.

By today's standards, radio equipment was extremely expensive. For example, in 1927, even after considerable factory automation, the manufacturing time for a receiving valve was 30 minutes. Naturally then, there was a strong motivation to adapt the family broadcast receiver for shortwave listening.

As use of the standard TRF receiver's RF section for shortwave was impractical, one common method was simply to use the broadcast receiver's audio amplifier and speaker, but to substitute a regenerative shortwave detector. Fig.1 shows how it was done very economically, by using an adaptor.

The receiver detector valve was transferred to the adaptor, and the connecting plug inserted into its original socket. This automatically powered the shortwave adaptor from the main receiver batteries and coupled it into the audio section — a practical, if inconvenient method of shortwave reception.

Frequency conversion

Experimenters soon found that, with an adaptor plugged instead into the socket of one of the receiver's RF amplifiers, another mode of operation became possible. By advancing the adaptor's regeneration control until there was continuous oscillation, it functioned as a rough and ready autodyne frequency converter. Oscillations and signals were mixed together, creating beat frequencies or heterodynes which could be amplified and detected by the broadcast receiver.

A combination of adaptor and a broadcast radio became in effect, a superheterodyne receiver with an IF operating somewhere between 550kHz and 1500kHz. There was, however, a major problem. The adaptor had only one tuned circuit and to provide the necessary beat frequency, this was tuned to the oscillation frequency, at least 550kHz removed from the signal frequency; the positive feedback necessary to maintain oscillations made the tuning very sharp and it tended to be seriously detuned by the received signal.

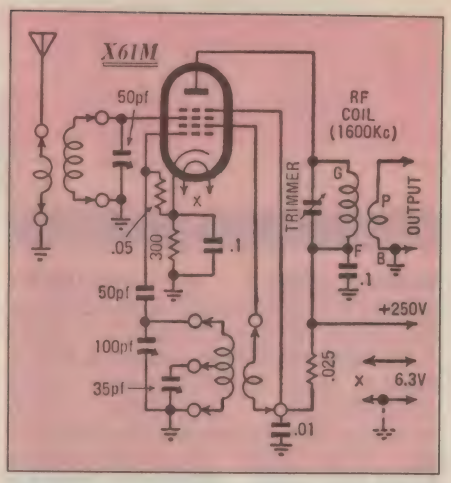


Fig.5: Frequency converter valves simplified shortwave converters considerably. This simple but popular design appeared in the July 1953 issue of 'Radio TV and Hobbies'.

This led to the development of a full scale frequency converter, incorporating an oscillator and mixer with an independently tuned non-regenerative detector and a separate oscillator valve. Connected ahead of a standard broadcast receiver, the combination created a true superheterodyne with a considerably improved performance over existing receiving methods.

(Continued on page 103)

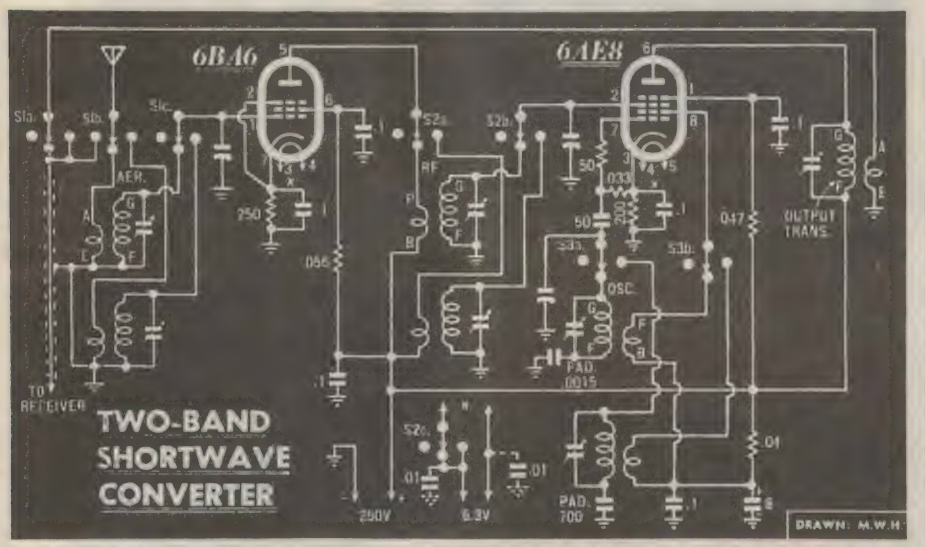


Fig.6: This two-band converter was a July 1955 R,TV&H project, incorporating an RF stage and high gain miniature valves. When coupled into a typical domestic receiver, performance would have been superior to anything short of a communications receiver. A connection of the receiver's AGC line to the grid circuit of the 6BA6 RF amplifier would have been a worthwhile refinement.

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VINTAGE RADIO

(Continued from page 101)

Shortly after this, late in 1930, superheterodyne restrictions were lifted — leaving manufacturers free to make converters. Many did so, one of the earliest being Stewart Warner. Whereas most home-made converters used separate tuning capacitors for mixer and oscillator, commercial manufacturers ganged the controls and as a major convenience, used *switched* rather than the admittedly more efficient *plug-in* coils. Many models like Stewart Warner's had their own filament transformer, with the small HT demand supplied by the main receiver.

More elaborate models, the 1932 Atwater Kent model 93 being a typical example, had their own power supplies and controlled the mains and aerial switching to the main receiver. As can be seen from the photograph (Fig.4), this model was intended to be closely integrated with its parent receiver and it was but a short step to include both in the same cabinet, with the odd looking arrangement of two dials and sets of controls. However, this was a makeshift combination and was soon abandoned.

Band switching

In Britain and Europe, right from the earliest days of radio, there had been simple switching between long wave and broadcast band coils. With converter shortwave band switching now proven, the obvious move was next to combine sets of broadcast band and shortwave coils, creating the familiar 'all wave' receiver. Some of the precursor American models appeared late in 1932.

The next year, there was a significant superheterodyne development in the form of the American pentagrid mixer valve and in Britain, the heptode, eliminating the need for a separate oscillator valve and simplifying receiver design.

With the advent of the all wave receiver, the demand for commercially built converters diminished, but there were still plenty of enthusiasts who wished to build them. Magazines regularly published details, and kitsets were popular. For five guineas ($10.50), Australia's Lekmek provided a complete kit with a pre-wired coil unit for a four band, four valve converter designed by *Listener In*. This was somewhat like the Atwater Kent, but with pentode mixer and IF stages. For the less ambitious home builder, a one-valve converter could give quite acceptable results, and a typical triode-hexode circuit is in Fig.5.

By the mid 1930's, with an ever increasing number of shortwave transmissions, some shortcomings of all wave receivers, especially the need for better image rejection, were becoming apparent. This had been improved somewhat by raising the intermediate frequency to the 450 - 475kHz region, and better class receivers with an RF stage and one or perhaps two IF stages performed well. Not so effective was the standard small 4/5 valve receiver without an RF stage.

An economical solution for the serious shortwave enthusiast was to build an advanced converter, the *Radio TV & Hobbies* design (July 1955) in Fig.6 being a good example. The combination of a well built converter of this type and a standard domestic radio, tuned to around 1500kHz, created what was in effect a double conversion superheterodyne which could outperform practically anything short of a full communications receiver.

Today, solid state converters are still used to provide special coverage or superior performance, especially for VHF work. But these are hardly *vintage* yet! ❖

50 and 25 years ago...

'Electronics Australia' is one of the longest running technical publications in the world. We started as 'Wireless Weekly' in August 1922 and became 'Radio and Hobbies in Australia' in April 1939. The title was changed to 'Radio, Television and Hobbies' in February 1955 and finally, to 'Electronics Australia' in April 1965. Below we feature some items from past issues.

November 1943

Car of tomorrow: The people's car of tomorrow, as visualised by British makers, will have: a 5hp super-charged engine, capable of high speeds on low petrol consumption; four-wheel drive, four-wheel steering, engine over the back axle; wooden bodies grouted with plastics, giving featherweight cars without body creaks; central heating, air-conditioning, and fog-piercing lamps. The four-wheeled steering is designed to enable the car to move crab-like into a parking space.

Magnetic acoustic torpedo: In a recent Atlantic battle with an Allied convoy, U-boats used a new-type magnetic torpedo. The torpedo, fired towards a ship from the stern, overtakes the vessel, and is exploded by the propeller vibrations. It combines magnetic guidance with acoustic detonation. The disabled ship, with propeller gone, is then an easy target for point-blank torpedo fire.

November 1968

Digital PCM exchange: An experimental pulse-code modulation (PCM) digital telephone exchange is undergoing field trials in London. In this method of transmission, the speech signal amplitude is sampled 8000 times per second, and each sample is expressed as a coded group of short pulses, similar to those used in digital computers.

Each group comprises eight pulses occupying a time slot; and 24 different time slots from separate conversations are interleaved to form a frame. The resulting stream of pulses is then at a rate of 1.5Mbps (millions of bits per second).

In addition to cost savings and providing public growth on existing cables, PCM transmission gives good quality speech, regardless of circuit length.

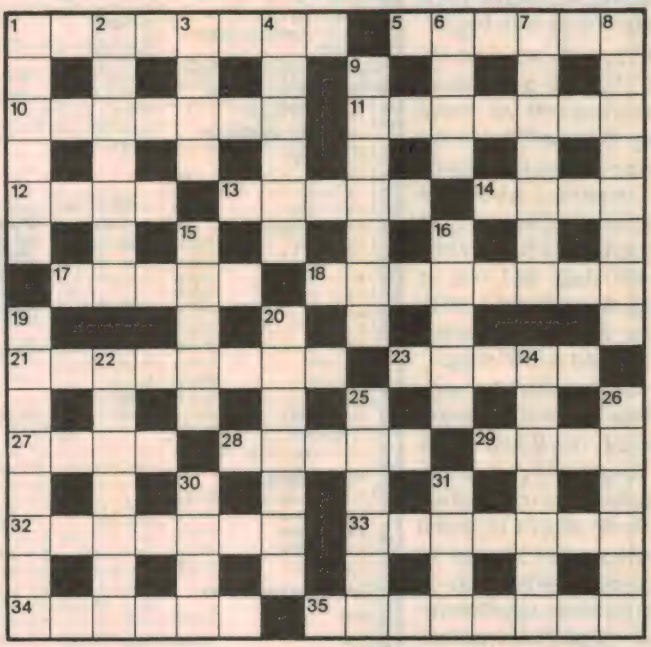
Optical cable research: A glass fibre cable communication system, which may supersede coaxial cable and microwave links, is being developed by the British Post Office Research Station.

The new cable would consist of hundreds of glass fibres in place of the copper wires in conventional cables. One fibre is capable of conveying thousands of times as much information as a pair of telephone wires, and several times as much as the large coaxial metal conductors or their equivalent microwave links.

One fibre would be about 0.1mm in outside diameter, with the vital central core being only a few microns. The information would be carried in pulse code modulation of an optical carrier wave, most likely a gallium-arsenide laser with a wavelength in the near infra-red region.

Small computers: The PDP-8/L has been added to the family of small computer lines marketed by Digital Equipment. It replaces the PDP-8/S as the least expensive full-scale general-purpose computer. The PDP-8/L is a complete high speed digital computer with a fully parallel processor and core memory of 4096 12-bit words with a 1.6us cycle time. ❖

EA CROSSWORD



ACROSS

1. EA construction project that eliminates knock, the electronic ——. (8)
5. Australian telecommunications authority. (6)
10. Metal forming basis of a switch. (7)
11. Long-established brand of hifi equipment. (7)
12. A circuit component. (4)
13. Recording start, —— Iglesias. (5)
14. Disable with shock. (4)
17. Render suitable. (5)
18. Part of a personal hearing device. (8)
21. Charged particle. (8)
23. Colour of active wire. (5)
27. Unidirectional transmission. (4)
28. Computer language. (5)
29. One of the given names of the discoverer of 21 across. (4)
32. Said of a network attenuating evenly over a wide frequency range. (3-4)
33. Business usually having an electronic barcode scanner. (7)
34. Saucer shaped structure for satellite sourced signals. (6)
35. Drink that sounds like an MF aerial. (8)

DOWN

1. Lightning surges can do this. (6)
2. Danish discoverer of an electromagnetic effect. (7)
3. Colour code for a neutral wire. (4)
4. Design. (6)
6. Supposed airborne objects. (4)
7. Building for play. (7)
8. Generators of sound. (8)
9. Type of fibre. (7)
15. Theatrical term for the beam producers. (4)
16. A reserve component. (5)
19. Device for digital data input. (8)
20. Such is a wave after a clipper. (7)
22. Makes active or operational. (7)
24. Rocket range. (7)
25. Type of switch. (6)
26. Catalytic molecule. (6)
30. Cyclic progression of energy. (4)
31. Part of a TV set. (4)

SOLUTION FOR OCTOBER 1993

F	L	O	P	P	Y	■	M	I	S	T	A	K	E	S
R	■	P	■	I	■	J	■	N	■	R	■	N	■	O
A	N	T	E	N	N	A	■	S	P	I	N	O	F	F
N	■	I	■	S	■	M	■	E	■	M	■	W	■	T
C	O	M	A	■	F	I	F	T	Y	■	S	H	O	W
K	■	U	■	B	■	E	■	■	■	S	■	O	■	A
■	I	M	P	U	L	S	E	S	■	P	O	W	E	R
U	■	■	■	I	■	O	■	E	■	A	■	■	■	E
N	O	B	E	L	■	■	N	I	C	H	R	O	M	E
E	■	E	■	D	■	■	■	U	■	K	■	A	■	S
D	E	A	D	■	B	A	I	R	D	■	E	X	I	T
I	■	T	■	S	■	L	■	I	■	T	■	W	■	A
T	R	I	P	P	E	D	■	T	R	I	D	E	N	T
E	■	N	■	O	■	I	■	Y	■	L	■	L	■	E
D	I	G	I	T	I	S	E	■	S	T	Y	L	U	S

Electronics Australia's

Professional Electronics

S • U • P • P • L • E • M • E • N • T

NEW AERIAL INDUSTRIES SPECTRUM ANALYSER HAS INBUILT WIDEBAND NOISE GENERATOR

SYDNEY TAFE'S NEW SMD FACILITY DEVELOPS REWORK SKILLS

ALCATEL'S NEW $100M R&D, SWITCHING PLANT

LATEST ADDITION TO HP'S 'BUDGET' INSTRUMENTS: THE HP-33120A SYNTHESISED 15MHZ FUNCTION/ARBITRARY WAVE GENERATOR, WITH 12-BIT & 10μHz RESOLUTION

NEWS HIGHLIGHTS

MM CABLES WINS $600K DEFENCE CONTRACT

MM Cables has recently won a contract for the supply of more than $600,000 worth of high voltage paper insulated cable to the Australian Department of Defence.

The contract involves the supply of 16,100m of three-core 70mm^2 copper 11kV paper insulated cable for the development of the new RAAF Base Scherger, near Weipa in far north Queensland. The cable supplied by MM Cables is being used as the power supply for the whole base.

As the outdoor environment in far north Queensland is susceptible to termites, the cables incorporate a nylon sheath as protection against termite attack, together with an outer sacrificial sheath of PVC.

The cables are also being supplied on steel cable drums, which were specially purchased for the job because they are impervious to termites and suitable for storage in an outdoor environment for a period of up to five years.

MPEG DECODER FOR ADSL VIDEO

US firm Microware Systems Corp is developing a domestic decoder for MPEG (Moving Picture Experts Group) digitally compressed video and audio, transmitted over existing telephone lines at 1.5Mbps using the asymmetric digital subscriber line (ADSL) system. The decoder is based on the Philips CD-I (compact disc interactive) full-motion video (FMV) specification.

US telco Bell Atlantic has been testing ADSL technology for a home subscriber video dial-up service, and Microware is apparently hopeful of being selected as the terminal used.

The Microware terminal uses a Motorola 68000 processor, running OS-9, in conjunction with a dedicated MPEG video and audio decoder chip. It also has an interface for connection to a standard TV receiver. The company expects the end user price to be around US$500.

COURT RE-OPENS FLASH PATENT CASE

A US Federal Circuit Appeals Court has overturned a decision by the US Patent Office to award Intel Corporation the patent for development of flash EEPROMs, ordering the Patent Office to

CRITEC WINS IE EXCELLENCE AWARD

Tasmanian power conditioning and transient protection specialist Critec was recognised with two awards in the Engineering Products category of the Tasmanian Division of the Institution of Engineers Excellence Awards, 1993, at Wrest Point Casino. The company received an Excellence Award for its Pro-Line range of Surge Reduction Filters with the new Movtec technology, and a Highly Commended award for its Sinetec HPI Inverter.

Critec's Movtec surge diverter is the first technology to offer high energy protection specifically designed to cater for the additional energy associated with the naturally occurring phenomenon found in 75% of all lightning, where multiple restrokes follow the main discharge in the space of tens of milliseconds.

The Sinetec inverter is designed to produce a clean 240V AC supply from standard 48V DC batteries used in Telecom exchanges. The design employs the latest high frequency switchmode power conversion techniques, to achieve 1kW of output power in a compact track mounted unit. Earlier this year, the product received an Export Endorsement Award from Telecom Australia.

Speaking at the award presentation ceremony held at Wrest Point to coincide with the opening of Engineering Week, Critec's Managing Director, Mr Rick Gumley said "The receipt of an Engineering Excellence Award is a proud achievement for our group. It is the culmination of years of dedicated research and an R&D effort which approaches an annual expenditure of one million dollars."

review the case. The matter was referred to the Appeals Court by Exel Microelectronics, a subsidiary of Japanese firm Rohm, which filed an application in 1984 and was granted a patent for EEPROM memory cell technology in 1987.

Many NOR-type flash EEPROMs, including those of Intel, appear to infringe the Exel patent. The only exceptions are those which use a polycrystalline silicon erase gate electrode, such as those made by Toshiba. However Intel has been fighting the Exel patent for some years, claiming that it developed the flash EEPROM and filed its application three weeks earlier than Exel. The Patent Office granted Intel's claims in August 1992, and it is this decision that the Appeals Court has now rejected.

DEATH OF FORMER CSIRO ASTRONOMER

Dr John Bolton, the distinguished Australian radio astronomer, died in his sleep on July 6 at the age of 71.

Dr Bolton was a member of the CSIRO Division of Radiophysics team which used the 'sea interferometer' to provide the first identifications of radio sources with optical objects other than the Sun — with the Crab Nebula in our galaxy, and with other galaxies. He established the Owens Valley Radio Observatory in the USA, and also commissioned and ran the Parkes Radio Telescope until 1971. Between 1969 and 1973 he led the Parkes support of NASA's Apollo missions, and played a major role in decisions to build the 48" Schmidt telescope and the 4m Anglo-Australian Telescope.

Dr Bolton received many awards, including Fellow of the Australian Academy of Science (1969), Fellow of the Royal Society (1973) and Commander of the Order of the British Empire (1981).

SA MILKMEN BUY COMPUTERS FROM NZ

The milkman with a pencil behind his ear and dog-eared notebook in his pocket is about to become a relic of South Australia's past, thanks to an A$1.3 million order for handheld computer units designed and developed in New Plymouth, New Zealand.

The Robinson Associates system includes an integrated printer capable of producing on-the-spot invoices, credit notes, receipts or quotations, yet it fits into the palm of the hand. It sells for A$3800 against A$7000 to A$9000 for competitive products, none of which provides the same features.

ALCATEL'S NEW R&D SWITCHING FACILITY

Alcatel Australia's new digital switching facility and R&D laboratories were officially opened on September 3, 1993, by the Minister for Communications, the Hon. David Beddall, MP.

The new centre represents an investment by Alcatel totalling over $100 million. With construction and equipment expenses approaching $50 million, and the remainder encompassing costs for training, transfer of technology and start-up, it is one of the most advanced complexes of its kind in the world.

Alcatel set out to establish a fully integrated facility in which software development, software and hardware production and final exchange testing were all coordinated and performed in the one location. The centre has provided a vehicle for closer cooperation and active participation in all aspects of exchange design and manufacture.

The manufacturing and test equipment, as well as procedures implemented across the various processes were selected from the most sophisticated available worldwide.

The company drew on the experience of other Alcatel locations, which have already deployed 24 million lines of System 12 exchanges in over 12 countries. Alcatel Australia has already delivered over 350,000 lines of System 12 to Telecom Australia.

With an initial capacity to produce approximately one million lines annually, the facility has the capability of extending production as required to over two million lines each year, to service markets both at home and overseas.

The company has also won contracts for 16 System 12 telephone exchanges, to be supplied to the Post and Telecommunications Authority (PTA) of Heilongjiang province in China.

"This brings the total value of Alcatel Australia's System 12 exports to China to $75 million," announced Chairman and Managing Director Bill Page-Hanify. "This total represents the largest export win for exchanges ever received by an Australian manufacturer, and firmly consolidates our position as Australia's leading telecommunications exporter."

The new Heilongjiang contracts are in addition to the supply of 21 System 12 exchanges for the PTAs in Qinghai and Anhui provinces, announced during the Prime Minister's visit to Beijing in June.

The contracts also involve the training of customers' engineers in both China and Australia.

South Australian milkmen deliver up to 320 different products a day and each unit can store input and output data on as many as 300 customers without any special programming by the user.

Already widely used in New Zealand, the Robinson units interface with computers operating in the Unix, Xenix or MS-DOS environments.

COMPACT DECODER FOR VIDEO ON DEMAND

Philips Consumer Electronics in Eindhoven, Holland, has announced a compact prototype digital set-top decoder for Video on Demand (VOD) applications over telephone wire. The designated Home Interactive Multimedia Terminal converts 1.5Mbps digital TV signals into NTSC or PAL analog signals for display on standard television sets. First applications are expected to be on Video Dial Tone (VDT) in the USA where telephone companies are experimenting with delivering digital TV signals into the home via existing twisted-pair telephone lines. Typically, hundreds of movies will be stored on a telephone network server. The user at home will view an on-screen catalog of the available movies and select the one wanted. It will then start to 'play' just like on a VCR at home.

The highly integrated Home Interactive Multimedia Terminal, incorporating key ICs from Philips' Full Motion Video system for CD-I, combines three systems in one compact unit: a standard TI com-

munications interface system, an MPEG-1 decoder and a control system.

This is the first of a series of terminals which will include versions suitable for use in ADSL and broadband fibre networks as well as for applications using satellite, cable, broadcast and other media. It will also play a useful role in business networks.

The announcement of the prototype terminal follows the formation of a joint working relationship between Philips Consumer Electronics Company in Knoxville, TN; BroadBand Technologies, Inc., based in Research Triangle Park, NC; and Compressions Labs, Inc., of San Jose, CA, to develop technology critical to the provision of interactive 'Video Dial Tone' services by telephone companies in the United States.

DR ZENER DIES

A recent letter published in *New Scientist* recorded the death of distinguished American physicist Clarence M. Zener on July 2, at his home in Pittsburgh. Dr Zener was 87, and worked as a Professor of Physics at Carnegie-Mellon University from 1968 until a few months before his death.

The well-known zener diode, used widely for voltage regulation and as a voltage reference in modern electronics, had its origin from a paper Dr Zener published in 1934. He was director of research at Westinghouse Electric for 15 years, from 1951.

HP LAUNCHES FAX INFO SERVICE

Hewlett Packard Australia has introduced HP FIRST, an automated 24 hour fax information and support service that provides a comprehensive library of HP PC, Networking and Peripherals information. By simply responding to a voice menu through their telephone keypad, the caller selects the information needed and keys in their fax number. The requested information is then transmitted to the fax machine of their choice.

In its first week, HP FIRST responded to more than 2000 requests for computer information from people across Australia and New Zealand. Included were hundreds of technical data sheets, configuration tips, software compatibility guides, pricing, product brochures and information on advertising and event invitations.

HP FIRST contains a product and technical library of almost one gigabyte of information that is available to customers, resellers, consultants, the media and the general public. It is far more comprehensive than many other fax-on-demand services where callers are automatically sent a few general brochures.

A caller is answered by a voice menu of options. The system has hundreds of documents on file, so first time users can request a faxed index of documents for their own area of interest. HP FIRST then asks the caller to key in their fax number and hang up. The requested information is then transmitted to the caller's fax machine. The customer pays only for the initial phone call. The cost of the fax is borne by HP.

The HP Australia communications group that implemented the system will now export the technology across Asia-Pacific, including installations in Korea, Hong Kong and Singapore. To use HP FIRST, simply dial (03) 272 2627.

OZ STUDENTS WIN IN DESIGN CONTEST

Motorola Semiconductor Products in Australia presented prizes to Monash and Queensland University of Technology students for their outstanding electronic projects, being classified among the best projects in the Asia Pacific region that entered the Motorola's 1991-1992 68HC11 International University Design Contest.

The 1991-1992 school term marked the fourth year of the Design Contest and the first year to include students from around the world. Participating countries were divided into three regions: North America, Western Europe and Asia Pacific.

The contest, which is part of Motorola's University Support Program (USP), is designed to challenge and cultivate engineering creativity in the university community.

"The Motorola USP in Australia supports universities with technical literature, discounts on semiconductor devices and development tools, and works with education institutions on specific equipment donation projects", according to Andrew Kung, Motorola Semiconductor Australia's Market Development Manager. "The honour to the winning students in Australia really demonstrated their talent and the achievements they could reach, provided they are given the appropriate support and tools to accomplish this."

Robert Distel from Monash University was the winner of the Asia Pacific region with his development of the 'Electronic Sheep', a robotic lawn-maintenance device that is time-programmed to search and cut grass.

Mr David Hill, Regional Manager of Motorola Semiconductor Australia, awarded Robert with the winning prize

Testing of high voltage transformers is one of the tasks undertaken by labs accredited with the National Association of Testing Authorities (NATA), which has just released its almost 900 page 1993 - 1994 Annual Directory. Copies are available for $140 from NATA, phone (02) 736 8222 or fax 743 5311.

which included an Apple Macintosh II personal computer, a laser printer and $500 cheque for having the entry published in a *68HC11 Applications Guidebook*.

Andrew Dennison from QUT had his project a 'Microprocessor Controlled Styrofoam Cutter', awarded as one of the outstanding designs. He also received a $500 cheque for having his entry published in the *Applications Guidebook*.

"The excellent results achieved by Australian students really encouraged us, and established a good example among universities here, and we are looking forward to more participation and even better results in the future competitions," said Mr Hill.

Both Monash and QUT were awarded $5000 worth of Motorola microcontroller products including development tools, in recognition of their effort for sponsoring the students' competition.

APPLE ORDERS AUSSIE MODEMS

Apple Computer has chosen Australian owned Banksia Technology as a development partner for the supply of high speed fax/modems for its Duo and Powerbook 160/180 PC families. The Banksia Express fax/modems are being sold as optional extras by Apple resellers.

According to Banksia Managing Director David Stewart, Apple approached major Australian manufacturers seeking an innovative company with a high level of technical expertise and reputation for quality products and service, which could respond quickly to market situations.

"We view it as a vote of confidence in Australian manufacturing, and especially in Banksia," says Stewart. "Response to our Apple modems at PC93 in Melbourne and to our initial telemarketing of the products has been encouraging. The deal has huge potential, since we can supply the whole Asia/Pacific area."

PC-BASED DSR FOR MPEG VIDEO

Scientific-Atlanta has developed a new digital storage and retrieval system (DSR) for MPEG-based compressed video and audio program material. The PC-based system will provide a low cost means for performing real time encoding, storage, distribution and playback of MPEG-based data files. Immediate applications include digital ad insertion, movie-on-demand, retail kiosks, and video education and training.

The DSR system will replace old storage methods in which cable operators, TV broadcasters and other users physically store huge volumes of analog videotapes. The ability to store materials digitally, with random access will substantially cut costs, space requirements and the time involved to store and retrieve video.

The system, which consists of a family of four personal computer boards, uses The International Standards Organisation (ISO) MPEG standard for digital video compression. The system also complies with the international CCIR 601 digital video standard for image resolution. A full range of user selectable horizontal resolutions is offered, including 704, 544, 480 and 352 pixels. The lower resolutions allow VCR-like quality programming to be transmitted over lines even as slow as T1. Scientific-Atlanta's DSR system is compatible with MPEG-encoded video at data rates ranging from 1Mbps to 8.3Mbps. Additionally, full I, B and P frame encoding is sponsored.

For further information contact Scientific-Atlanta Australia, on (02) 452 3388.

RAMTRON WINS BIG ORDER FROM SEGA

Ramtron International Corporation, the US based semiconductor manufacturer, has announced that Japanese game manufacturer Sega has placed a multi-million unit order for Ramtron's 4-K FRAM ferroelectric memory chips.

The Ramtron chips were chosen by Sega primarily for their cost benefits, as well as for high reliability and long life cycle.

FRAM memory singularly replaces a competing non-volatile memory solution — i.e., the more expensive combination of a lithium battery, a controller chip, and a Static Random Access Memory chip (SRAM). The latter configuration has been used in manufacturing Sega's top selling video game cartridges.

The multi-million dollar order follows on the heels of a 100,000 chip order placed by Sega some months ago. As had been expected, Sega becomes the first company to place a multi-million unit order of Ramtron's FRAM products. Production of the chips has already begun at Ramtron's Colorado Springs plant, with delivery expected before the end of the year.

FRAM semiconductor memory chips from Ramtron are considered by many — including industry giants Hitachi Limited and ROHM Company Limited of Japan, which are in strategic programs with Ramtron — to be the next generation of semiconductor memory.

WORLD TRADE FAR FOR SYDNEY IN 1994

New export and trade opportunities will receive a boost from the Sydney World Trade Fair, Australia's first of its kind, to be staged in February next year.

According to World Trade Centre Sydney Director of Marketing, Geoffrey Somerville, a long list of companies are preparing for this important trade event. Participants include Australian and international distributors, service suppliers, associations, public sector organisations and overseas Government trade representatives.

Interest in the Fair is also running high in many parts of the world. Overseas representatives are planning business groups to the Trade Fair, which are expected to include delegations from Japan, Indonesia, India, Pakistan and China as well as a number of European countries.

The Sydney World Trade Fair '94 is being organised and promoted by World Trade Centre Sydney, and will be staged from February 5 to 9, in Halls 1 - 5 of the Sydney Convention and Exhibition Centre at Darling Harbour.

The satellite-linked electronic trading network is showing early evidence of becoming a strong instrumentality in providing Australian companies with new overseas business opportunities. ❖

NEWS BRIEFS

- ***Fairmont Marketing*** has appointed John Giannetti as Sales Representative for Victoria. He will be responsible for further developing OEM sales and reviewing new opportunities within the electronics industry.
- Powersense Technology (England) has appointed ***Westinghouse Industrial Products*** as distributors of its Power Disturbance Analyser Instruments.
- ***Kenwood Electronics Australia*** has announced changes in management. The company's Managing Director Mr Ted Ito and Mr Hiroyuki Yamashita who currently heads Kenwood's Panama operation will swap positions. Mr Hiromosa Shimomiya will replace Mr Kiyoshi Sakamoto as the local Product/Marketing Planning Manager (Audio).
- ***Scientific Devices Australia*** has announced that Giga-tronics has acquired the Fluke RF Signal Generator product lines. Giga-tronics will assume responsibility for design, marketing, sales and support for all Fluke customers.
- ***ACOFT-18 '93***, the 18th Australian Conference on optical fibre technology, will be held at Novotel Northbeach, Wollongong NSW, from Sunday, November 28th to Wednesday, December 1st, 1993. For more information, contact IREE Head Office, PO Box 79, Edgecliff 2027; phone (02) 327 4822, fax 362 3229. ❖

Multi-purpose RF Test Instrument:

Aerial Industries' HP2-TS Spectrum Analyser

This new instrument should be of great interest to anyone involved in antenna installation (including satellite dishes), designing/installing/servicing multi-way RF distribution systems, or testing of filters and diplexers. It combines a VHF/UHF spectrum analyser and field strength meter, a multi-standard TV receiver and a calibrated wideband noise source — all in a very compact portable case, with in-built NiCad battery supply.

The HP2-TS Spectrum Analyser is clearly meant for portable use; its compact case is fitted with a flip-down protective cover for the front panel, and the rear has four sturdy feet so that the instrument is even *relatively* stable when standing upright. This is in addition to the very solid carrying handle, which doubles as a tilting bail.

Apart from these physical attributes, the instrument is also fitted with a 12V NiCad battery pack, capable of running it for approximately one hour. The pack attaches to the rear of the case, between the feet, and there's a matching plug-pack supply which doubles as a charger. (Recharging takes about 12 hours.)

Incidentally although compact, the analyser is by no means tiny. It measures 265mm wide by 80mm high, and is 415mm deep. It weighs in at 4.1kg, including battery pack.

When it comes to the functions performed by the HP2-TS, it's hard to know where to start. Obviously it's a spectrum analyser, as the name suggests, but there are quite a few additional functions — each designed to increase its value to those working with antennas and distribution systems at VHF and UHF.

For example there's a built in multi-standard TV receiver, which uses the same 75mm (diagonal) monochrome CRT used for the spectrum analyser display, and has its FM sound detector tuneable from 4.5 to 6.9MHz. There's also an internal calibrated wideband noise generator, which is designed to be used in conjunction with the spectrum analyser for checking the performance of filters, attenuators, diplexers, traps etc. With an optional bridge reflectometer attachment the HP2-TS can even be used for measuring the impedance of antennas and other loads, and for checking the electrical length of co-axial cables at different frequencies. In short, the HP2-TS is almost a portable VHF/UHF test lab, with capabilities which make it suitable for most field work.

Even the spectrum analyser section offers an impressive range of functions — rather more than we've seen on comparable instruments. The basic tuning range covers from 46 to 860MHz, in three bands: 46 - 170MHz, 170 - 450MHz and 450 - 860MHz. This covers the TV and FM broadcasting bands, high and low-band VHF mobile radio, many of the UHF mobile bands, the old 500MHz mobile telephone band, and even the mobile-to-base channels used by AMPS (analog) mobile telephones. It also covers three of the VHF/UHF ham bands as well as the UHF CB band, of course.

With an optional downconverter attachment called the HP2-C, the instrument can also cover the standard first IF range used for satellite TV: from 950 - 1850MHz, in two overlapping ranges. This allows the combination to be used for checking things like dish alignment, LNB polarisation alignment and cross-polarisation ratio, LNB gain and noise performance, the received carrier levels from various transponder channels, and IF downlead performance. The downconverter is a small unit about 70 x 60 x 20mm, which attaches to the instrument's RF input connector (BNC) and has a small flying lead which connects to a SCART connector on the side, for power, etc.

Features of the spectrum analyser include switched IF and RF attenuators, with ranges of 30dB and 60dB respectively (10dB steps), giving the instrument the ability to display and measure input signals in the range from 25 to 140dBuV. The signal level scale resolution is 1dB steps, and the rated accuracy is within 2.5dB after a 15-minute warmup.

On the frequency side, the instrument provides an inbuilt marker generator whose frequency is indicated on a four-digit frequency meter with a resolution of 100kHz on the main VHF/UHF ranges, and 1MHz on the satellite IF range. The actual marker frequency is adjusted using a pair of 'Up' and 'Down' keys, and is visible on the analyser display by a black horizontal line. (The analyser displays 'sideways', with the baseline on the left and the signal level scale along the top, reading from left to right.)

The analyser's sweep deviation is continuously adjustable from 500kHz up to the full width of the band currently selected, so that you can either examine a wide chunk of the spectrum as a whole, or 'zero in' on a band or signal of interest. There's also a choice of two IF filter bandwidths — a 'wide' (TV-W) setting with a bandwidth of 800kHz for assessment of overall signal levels during wide sweeping, or a 'narrow' (RD-N) setting with 100kHz bandwidth for closer analysis of individual signals.

TV reception

When switched for TV reception, the HP2-TS tunes over the same three basic ranges as the analyser — which is what you would expect, of course, since they share the same front end. As well as providing continuous tuning using another pair of Up/Down buttons, it also provides a set of memories for storing the tuning frequencies for up to 39 channels, for rapid setting up.

The receiving video detector will demodulate PAL and NTSC (and SECAM with an option), and also transmission standards B/G/I/D/K, M and L (with the SECAM option). As well as being displayed on the 75mm monitor screen, the video is also made available at the SCART connector.

The FM sound detector can be tuned via a front-panel control for a separation of anywhere from 4.5MHz to 6.9MHz.

The audio is fed to a small internal speaker, and again also made available at the SCART connector (both channels). Volume is adjustable digitally, using a pair of Up/Down buttons, and there is also a separate muting button.

A very nice feature of the instrument in TV reception mode is that the received signal level is simultaneously displayed along the top of the picture (where the level scale is located), so that it can function as both a tuning guide and a signal level indicator.

Noise generator

The wideband noise generator built into the HP2-TS has a rated coverage of 35-2000MHz, and delivers its 75-ohm output at a subminiature 'SMB' co-axial connector on the side of the case. The output level is rated at 50dBuV, as measured by the spectrum analyser in its 'wide' (800kHz) IF bandwidth setting. Rated flatness is +2/-1dB from 10 to 900MHz and +/-1.5dB from 900 to 2000MHz, at 20°C and after 15 minutes warming up.

The addition of this noise generator really does enhance the capabilities of the analyser quite significantly, because it provides what is effectively a source of test signals covering the analyser's full frequency range. In fact the two of them form what can be used as a 'poor man's network analyser', to examine and measure the performance of filters, attenuators, diplexers and other network components over the frequencies concerned. The accuracy is only modest by comparison with a full-blown lab type network analyser, but the cost is also much lower!

Other features of the HP2-TS include a built-in thermostatically controlled cooling fan, a level buzzer to give an audible indication of received signal level, and the availability of a DC voltage proportional to RF signal level at pin 11 of the SCART connector for such uses as driving a recorder or plotter. It comes with a shoulder strap, adaptor cables and connectors, a telescopic antenna with BNC plug and a reflectometer slide rule.

Trying it out

We were able to try out both an HP2-TS Analyser and a matching HP2-C satellite IF downconverter for a few days, by courtesy of the Australian distributor Peter Lacey. This allowed us to use it not only as a spectrum analyser, in the VHF, UHF and satellite IF segments of the spectrum, but also check the operation of the receiver and noise generator sections at VHF and UHF.

As a spectrum analyser we found it very convenient to use, especially on the internal VHF/UHF bands. The 'sideways' display is quite easy to get used to, and the marker generator makes it easy to identify particular signals and even individual signal components (like stereo sound subcarriers).

Operation with the HP2-C is almost as convenient, although the downconverter itself does tend to block access to some of the front panel controls a little. The way it provides two overlapping frequency ranges is also slightly messy, but neither of these aspects is a major problem.

As a receiver we also found the HP2-TS quite easy to use, and its ability to display signal strength along with the video not only facilitates optimum tuning, but allows measurements to be made at the same time.

Probably the thing that impressed us most about the instrument, though, was the way the inbuilt noise generator can be used with the analyser to measure the performance of filters, traps, attentuators, splitters and so on. This works out to be a very handy facility indeed, especially when you have the marker generator and its digital display to allow measurement of corner frequencies, maxima and minima. In short, then, the HP2-TS strikes us as a particularly flexible and useful instrument for anyone working with antennas and distribution systems at VHF and UHF. For the quoted price of $3500, it seems very good value for money. The optional HP2-C satellite IF downconverter costs an additional $295. Neither of these prices include sales tax if applicable.

Further information on the instrument is available from Peter C. Lacey Services, 80 Dandenong Road, Frankston 3199; phone (03) 783 2388, fax 783 5767. Our thanks to Peter for the opportunity to try out the instrument. (J.R.) ❖

Solid State Update

KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY

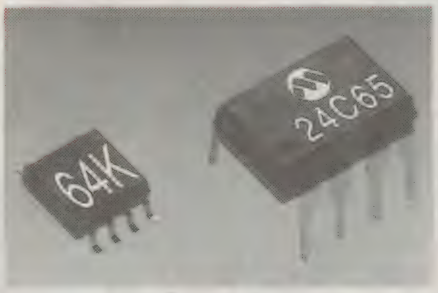
64Kb serial EEPROM

Arizona-based US Microchip Technology has introduced the 24C65 Serial EEPROM, claimed to be the world's first 64Kb Serial EEPROM, and the first in a new family of serials specifically developed to meet designers' needs for dramatically increased memory and functionality with no increase in packaging size.

With its 64Kb density, the 24C65 provides four times more memory than a standard 16Kb Serial EEPROM in the same 8-lead SOIC.

It also offers a 400kHz bus rate for faster data throughput, a 64-byte data input cache for faster write loads, field programmable security options for system flexibity, and the ability to configure up to eight 64Kb devices on the same bus, for up to 512Kb total Serial EPPROM memory.

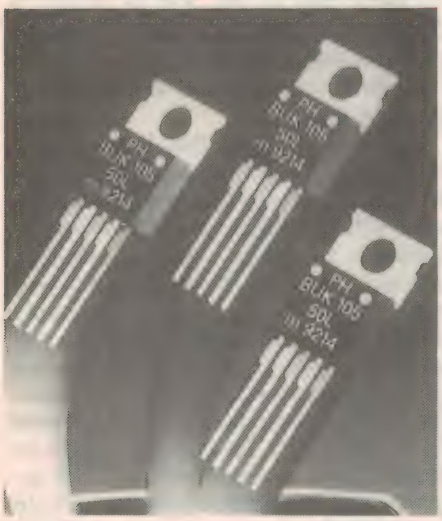
The security options are particularly useful for products such as cellular



phones and electronic keys, where data protection is critical. The 24C65 has a fixed 4Kb block of ultra-high endurance memory (one million erase/write cycles typical) for data that changes frequently; the remainder of the array, or 60Kb is rated at 10K erase/write cycles minimum. This split endurance design makes it ideal for non-volatile code and data applications.

For further information circle 271 on the reader service coupon or contact NSD Australia, Locked Bag 9, Box Hill 3128; phone (03) 890 0970.

Fast switching TOPFETs



With the introduction of the BUK105-50L/S, Philips Semiconductors extend its existing three pin TOPFET (Temperature and Overload Protected Field Effect Transistor) range with five pin versions.

This second generation of devices is suitable for a wide variety of applications. They can be used as a general purpose switch for lamps, motors, heaters and solenoids, in automotive and other 12V systems where protection of the switch and fault condition notification are required.

In addition to switched operation, the series can be used in linear mode, without loss of protection. The BUK105/50L/S is designed to reduce circuit complexity and improve reliability in a wide range of automotive and similar applications.

The new devices have the same basic design as the 50GL, which Philips introduced last year, but are provided with a separate supply pin for the logic and protection circuits, and a 'flag' pin for reporting faults. Having a separate supply pin allows the MOSFET gate to be independently controlled, without adversely affecting the protection features — essential for safe operation in applications like linear control.

The flag pin of the BUK105 can be used to notify the system of faults, but can also be used to control the input to a low impedance gate driver stage. This, combined with the direct connection between the input pin and the MOSFET gate, allows the BUK105 to be used in high frequency PWM applications. Also, with a nominal protection supply voltage of 5V, it can be driven by standard 5V logic families and CMOS microcontrollers.

For further information circle 274 on the reader service coupon or contact Philips Components, 34 Waterloo Road, North Ryde 2113; phone (02) 805 4455.

24-bit VGA colour controller

The TVGA8900CX is a Video Graphic Array (VGA) controller chip that allows PCs to display 24-bit photo-realistic images, and improves the graphics performance of MS Windows.

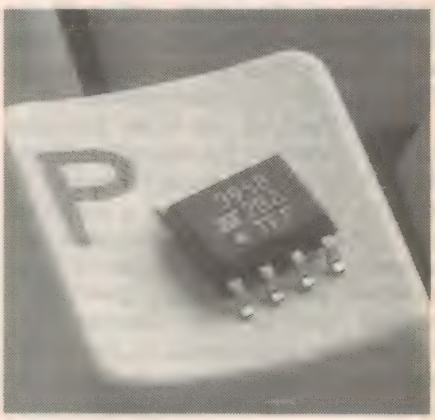
The chip can interface with the industry Standard Architecture (ISA), Micro-Channel and local buses. The local bus interface lets the chip communicate directly with 80386 or 80486 processors, allowing graphics memory transfers to move at the speed of the host CPU.

The chip supports a 640 x 480 pixel, 24-bit colour mode, and a variety of display resolutions from 640 x 400 to 1280 x 1024 pixels (in 256 colours interlaced, and 16 colours non-interlaced). It is hardware compatible with Enhanced Graphics Adaptor (EGA), Colour Graphics Adaptor (CGA), Monochrome Display Adaptor (MDA), and Hercules (at the register level). It also provides plasma-display control, and supports analog monitors.

For further information circle 272 on the reader service coupon or contact Veltek, 18 Harker Street, Burwood 3125; phone (03) 808 7511.

Highly efficient P-channel MOSFET

A very low p-channel on-resistance is being reported for a new complementary dual MOSFET released by Siliconix. The new Si9958DY, a 20V, 3.8A device, is one of the first parts to use Siliconix' new dense-cell p-channel technology and is the latest of the company's surface-



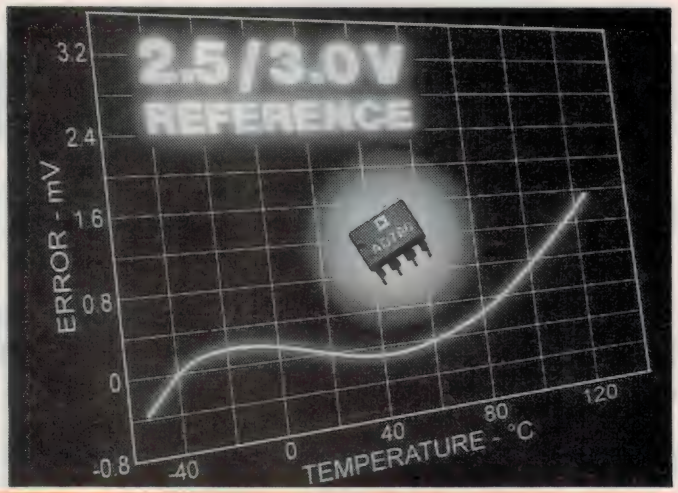
Pin-selectable voltage reference

Analog Devices' AD780 is a very accurate 2.5V monolithic voltage reference, and is the first voltage reference to offer a pin-selectable 2.5 or 3.0V output. Initial voltage error for either 2.5 or 3.0V operation is only +/-1mV, while maximum voltage temperature drift is only 3ppm/°C. Voltage output noise is typically 100nV√/√Hz, and the AD780 is able to drive capacitive loads up to 1uF, making it a good match for all precision data acquisition applications, especially those emplying high resolution, sigma-delta converters.

A 'low headroom' design facilitates a 3.0V output from a 5.0V supply which, combined with the AD780's low noise performance, provides a significant boost to dynamic range in data acquisition systems.

The reference is able to sink/source up to 10mA, and can supply a positive or negative output voltage without any external components. The AD780 is a pin-compatible upgrade for both the LT1019 and the AD680.

For further information circle 280 on the reader service coupon or contact NSD Australia, Locked Bag 9, Box Hill 3128; phone (03) 890 0970.



mount 'Little Foot' products in small outline packages.

With $r_{DS(on)}$ at 100 milliohms per MOSFET, the Si9958DY is optimised for 12V motors in data storage devices such as tape drives and hard disk drives. Its space saving SO-8 package will also make it ideal for small form-factor end products like notebook computers.

In a chip set with Siliconix' Si9150 buck regulator controller IC, the Si9958DY can be used to make a highly efficient, surface mount, 2.5A DC to DC converter for battery operated equipment. When built to Siliconix specifications, such a converter will be more than 90% efficient at an input voltage of six to 10V, with a 3.3V, 2A output.

For further information circle 276 on the reader service coupon or contact IRH Components, 1-5 Carter Street, Lidcombe 2141; phone (02) 364 1766, fax 647 1545.

Dual audio op-amp

Analog Devices' SSM-2135, a dual channel op-amp, offers a special set of performance specifications for +5V single supply audio applications, including ultra-low noise and distortion, wide voltage output swing, and high current output.

Computer and digital audio systems will particularly benefit from the SSM-2135's ability to drive headphone loads (approximately 24 ohms) directly, with ultra-low distortion and without the addition of higher voltage and/or negative supplies. A 5.2nV/√Hz voltage noise density at 1kHz also makes it well suited for microphone preamplification.

Balanced line driving and receiving, and sigma-delta ADC buffering are also among this op-amp's repertoire of single supply audio applications. Additionally, it can be used as a low pass filter and current-to-voltage converter, smoothing the over-sampled audio output signal of an 18-bit DAC, for example. The unity gain stable SSM-2135 is especially suitable, however, for use with high performance stereo audio codecs like Analog Devices' AD1848 and AD1849, in high performance computer audio systems.

For further information circle 277 on the reader service coupon or contact NSD Australia, Locked Bag 9, Box Hill 3128; phone (03) 890 0970.

Three tune sounder IC

The new Siemens SAE 800 sounder IC has three different programmable sound patterns built-in on a single IC, and with a single hardware format. The chip is very suitable for a seat-belt warning device, or even a doorbell. The volume is adjustable and even battery operation is possible, for example for toys. However, the large operating voltage range — from 2.8 to 18V — means that applications with just a bell transformer diode and capacitor are also possible.

The SAE 800 is equipped with overtemperature and overload protection and has low current drain in standby mode. The external wiring consists of an oscillator resistor and capacitor, a volume resistor, a loudspeaker capacitor and a filter capacitor for the supply voltage. The chip is available both in a P-DIP package and as a surface mount device (P-DSO-8).

For further information circle 273 on the reader service coupon or contact Siemens Advanced Information Products, 544 Church Street, Richmond 3121; phone (03) 420 7716, fax 420 7275.

1W, 1GHz amplifiers

Avantek, a subsidiary of Hewlett-Packard, has introduced two new high performance 1W output (1dB gain compression) Class-A amplifiers in TO-3 packages, covering 10 to 500MHz and 10MHz to 1GHz. In addition to amplifiers specified for operation over -55 to +85°C, Avantek also introduced low cost commercial versions, with guaranteed performance at 25°C.

The CTO/UTO/UTC-565 provides 10 to 500MHz coverage, with 19.5dB gain, +30.5dBm output at 1dB gain compression, +/-0.3dB flatness, 8dB noise figure, +41dBm third order intercept point, and a current consumption of only 450mA at +18V DC. The 1GHz model 1065 has a similar performance with slightly less gain (14.5dB) and slightly higher current consumption (470mA). Both amplifiers feature a very high efficiency for 1W output Class-A wideband amplifiers, dissipating only 8.5W.

For further information circle 278 on the reader service coupon or contact VSI Electronics, PO Box 578, Crows Nest 2065; phone (02) 439 4655. ❖

Training for the future:

New TAFE facility develops SMD skills

The managing director of Royel International, Alan Royston, recently opened a new facility at the Sydney Institute of Technology Ultimo (SITU), which will provide training in high reliability soldering, with an emphasis on surface mount technology.

by PETER MURTAGH

Unlike the high-tech setup at Lidcombe College of TAFE, with its $300,000 Heeb HM-60 pick-and-place machine, the SITU facility is set up with far less expensive equipment, with each station costing slightly under $5000. Despite this, the total cost of the equipment in the new soldering room is well over $100,000.

There is nothing new in TAFE running soldering courses for those who repair electronic equipment. However, what *is* new is that the SITU courses now include resoldering SMDs — and these days many TV sets, video recorders and a host of domestic appliances are full of surface mount components. Because it is estimated that around 90% of SMD repairs do not require expensive, high-tech machines, this new facility should prove to be very popular.

The SITU dedicated soldering room includes 10 separate surface-mount rework stations, each with its own hot air preheater. There is also a video microscope and an integrated pick-and-place rework station located in the room. All the equipment was supplied by the Melbourne-based Royel International, at a very subsidised price. An Australian Government grant also assisted TAFE to set up the facility.

At each station the hot air preheater maintains the PCB being worked on at a typical temperature of around 100°C. Its ramp-up rate is only 2° per second, to prevent the ceramic base cracking. Reworking can then be done either by using a fine-tip soldering iron or by removing all the solder and starting again.

A hot air suction tool, with various sized tips, is placed over each pin of the IC in turn, and removes all the solder, even with plated-through components.

The advantage of preheating is that the iron or desoldering barrel needs only to be around 350°C — if either tool were the only heat source, then the temperature would need to be another 50° higher to compensate for heat lost to the ground plane, etc. Each station also has hot-air heated tweezers to remove the IC after desoldering.

The safety aspects of desoldering are also looked after, with a separate fan on each desk to extract the fumes and remove them via an activated charcoal filter. This unit also has a built-in light which can be directed on to the work bench.

Special provisions have been taken to minimise the risk of damage from static charge. For example, each item of equipment has a separate earth connection; the same type of metal has been used in the construction of the soldering tools to avoid any electrochemical voltage differential; and special carbon-impregnated insulating plastics have been used, which are less likely to hold a charge.

Extra equipment

The soldering room is also equipped with a video microscope. The board to be

Left: One of the new 10 hot-air rework stations. In the centre of the desk is the preheater, with the exhaust fan above. The operator is using the hot-air tweezers to remove the surface mount device. Right: By placing a surface-mount PCB under the x40 microscope, the video screen clearly shows the accuracy of the reworking. Any unsatisfactory joints or solder bridging are immediately obvious.

For the 10% of joins where you can't 'eye-ball' the device, the Planer SR7-100 rework station allows precise alignment and placement of the surface mount components.

inspected is placed beneath the microscope and illuminated with two small bezels which are connected via optical fibre to a light source. These apply highly directed, intense lighting to any area. With a magnification of up to x40, the image of a 14-pin IC will take up most of the screen on the video display. If a solder joint is not acceptable, or tracks are bridged, then the enlarged image makes this obvious to everyone!

Another piece of equipment in the room is the $38,000 Planer SR7-100 hot air rework machine, complete with colour monitor. This level of technology is necessary when the repairer is unable to 'eye-ball' the soldered connections. The machine picks up the component by suction, and the operator can rotate the PCB through 360° to allow for easy alignment. The hot-air tools can be positioned precisely — and all components and movements are magnified and displayed on the video screen.

The future

Many appliances already incorporate some surface mount components, and it is predicted that soon almost all electronics will be *only* surface mount. So it is good to see TAFE training people to be able to repair this new technology, rather than having to discard faulty boards — perhaps because of just one failed component.

Small repairers are far more likely to be able to afford the basic rework stations, which SITU is using for its current training, than very expensive pick-and-place machines. ❖

Special Feature:

Power supplies and conditioning products

Power line disturbance logger

A new hand held Power Quality Monitor, the Powersense PQM-1000, is fully pre-programmed to log the 15 most common types of power line disturbances. It uses voltage and frequency thresholds that are commonly acknowledged as being applicable for malfunctions and data corruption in sensitive electronic, industrial controls and computer systems.

The PQM-1000 can provide answers to the following: How dirty is the mains supply voltage? What type of power disturbances are present, and how many? And, how effective are your mains conditioners, filters, spike clippers and uninterruptible power supplies, etc?

A two line LCD provides a 'real time' display of line voltage and frequency, high frequency noise (L-E and N-E), and the disturbance event counts. The battery baked memory holds data during prolonged power failures. LED indicators are provided to show occurrence of past or present disturbances.

The 15 power disturbance event counters log the occurrences of power failures (blackouts); voltage drops (sags); low line voltages (brownouts); voltage surges; high line voltages (over voltages); voltage spikes line to earth and neutral to earth (impulses); high frequency noise line to earth and neutral to earth (impulses); and high/low line frequency. The PQM-1000 uses a standard three-pin mains plug connection to the power point, to both power itself and monitor the supply. Standard versions are available for 240V, 230V and 220V (50Hz), plus 120V (60Hz).

For further information circle 202 on the reader service coupon or contact Westinghouse Industrial Products, 59 Stephenson Street, Spotswood 3015; phone (03) 391 1300, fax 391 6607.

Inexpensive UPS

Anyone who runs a computer knows the trouble caused when the system crashes due to a mains power blackout. But the installation of an uninterruptible power supply system (UPS) means that the connected computer system will be supported for more than sufficient time to allow an orderly shutdown of the computer system — thereby preventing any potential data loss of computer hardware damage.

The Victorian based company Upsonic has several 'PC Might' UPS systems which start from $400 for the typical desktop system, and end at around $3000 for the large system. There are six units

Three phase power meter

Yokogawa has announced the release of its new high accuracy, three-phase 2533E Digital Power Meter, intended for R&D, industrial and production applications.

The 2533E uses a 16-bit PWM (pulse width modulation) measurement principle to measure DC and AC voltage, current and power, to an accuracy of up to 0.1% in single phase, three-phase three wire and three-phase four wire power circuits. Offering a frequency response of 30Hz - 30kHz, as well as DC capability, the 2533E is also capable of accurately measuring power of distorted and inverter waveforms.

Three large bright displays simultaneously show any three values of either measured or computed data. The display function is changed by simply pressing a front panel button. These can include, for example, voltage, current, power per phase, total power, apparent power and power factor. As well as display output, the 2533E provides 12 analog output signals, standard for connection to auxiliary instruments such as recorders and FFT analysers.

Several further computation functions are provided, such as mean value of phase or line voltage, and mean value of phase current. An integration option is available allowing measurement of AH or WH to an accuracy of (+/-0.2% + 1 digit), up to a period of 999 hours. A further option allows frequency measurement over the range of 20Hz to 200kHz, with an accuracy of (+/-0.1% + 1 digit). GPIB and RS-232C communications options are provided, allowing the 2533E to be remotely controlled, and output data to be easily transferred to a PC.

For further information circle 201 on the reader service coupon or contact Yokogawa Australia, Centrecourt D3, 25-27 Paul Street North, North Ryde 2113; phone (02) 805 0699, fax 888 1844.

in the range — 250VA, 350VA, 500VA, 800VA, 1400VA and 2000VA.

For further information circle 203 on the reader service coupon or contact Upsonic, Slough Business Park, Janine Street, Scoresby 3179; phone (03) 764 0074, fax 764 0128.

Energy analyser

The new Dranetz 8000-2 Energy Analyser is claimed to analyse all of a power system's electrical characteristics.

The rugged field instrument contains the best features of: true RMS voltmeter and clamp-on ammeter; oscilloscope; event monitor; phase angle meter; harmonic distortion analyser; neutral-to-ground monitor; and demand/-energy use analyser.

Additional new features include: motor inrush analysis; harmonic analysis

(IEEE-519, IEC-5555); rate schedule analysis; PC analysis software; and removable IC memory cards.

Weighing 9.5kg, the unit is compact, lightweight and durable making it ideal for field use. The carrying handle is padded and the case is made from high impact plastic to protect against damage.

For further information circle 206 on the reader service coupon or contact AWA Distribution, 112-118 Talavera Road, North Ryde 2113; phone (02) 888 9000, fax 888 9310.

Line surge protection

Queensland based Precision Power now designs and manufactures its own range of line filters and uninterruptible power supplies. The need for this type of protection is because the power delivered by the Electricity Authority collects many impurities, including large momentary voltage surges, as a result of lightning strikes, line switching, operation of lifts and air conditioning motors, welders and even some laser printers.

These very high voltage spikes of micro-second duration do not affect electrical equipment such as motors and heaters, but can be damaging to sensitive equipment. The only effective protection is to install a line filter on the computer power supply, to ensure that the computer chips operate electronically within their comfort zone. The company claims that many cheap line surge suppressors do not have the internal circuitry capable of coping with major power line disturbances.

Precision Power line filters range from simple passive filters, which clamp line voltage at 275V maximum, to more sophisticated active tracking filters, which follow the sine wave by the cycle and prevent the voltage at any point on the wave varying more than 2V from normal at that instant.

Many pieces of equipment have microprocessors similar to computers, which are vulnerable to line surges. These include fax machines, photocopiers, programmable logic controllers, PABXs, registers, etc.

Precision Power has a range of technical literature on the topic, and offers a technical advisory service for electrical contractors.

For further information circle 204 on the reader service coupon or contact Precision Power, 12 The Corso, Norman Park 4170; phone (07) 395 7433.

DC-DC converter

The Power General HDU1-35 provides compact, distributed low voltage power for mixed 3.5V/5.0V or 2.0V/5.0V environments. The single output DC-DC converter minimises power bus complexity and system design time, by placing a stable, regulated low voltage supply where it's needed.

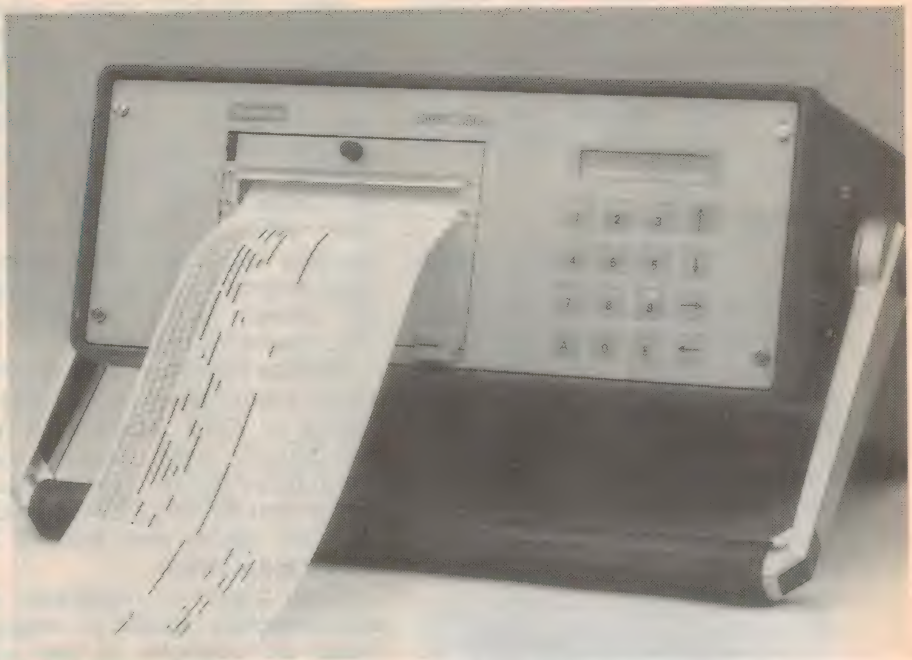
Output of the high density converter is user selected either 3.3V at 10A or 2.0V at 12A. Its 51 x 51 x 21mm modular format include six-sided shielding and a top-mounted heat sink.

The HDU1-35 features 10W/in^3 power density, remote shutdown, continuous short-circuit protection, and low EMI figures due to an integral pi-input filter. It exhibits an MTBF (mean time between failures) of 200,000 hours, minimum — calculated using the stringent MIL-HDBK 217E 'parts stress' method.

The line/load regulation for the device is 1.0%, while the output ripple and noise are 100mV, peak-to-peak, maximum.

For further information circle 210 on the reader service coupon or contact Priority Electronics, 23-25 Melrose Street, Sandringham 3191; phone (03) 521 0266, fax 521 0356.

Voltage pulse recorder



The Siemens Sinec 3500 pulse recorder is a new portable recorder for measuring and recording AC and DC voltage pulses on up to 32 channels. A time dependent yes/no graph printed on thermosensitive paper iindicates whether a voltage is present, or whether contacts are open or closed. The recorder can be used as a permanent monitor and recorder of binary signals from industrial control and automatic systems, or in power installation.

There are three different recording modes. In the pulse recording mode, which is triggered either manually or by pulse signal, time-proportional graph lines are produced for each channel against a time scale; while in the time-marking mode, the trigger lines are presented in an alphanumeric line-by-line fashion with a 1ms resolution. Finally, in the reporting mode, the Sinec 3500 assumes the function of an event recorder, printing out alphanumerically time, channel, number and event description.

The main application of the Sirec 3500 lines in the area of troubleshooting, because it can record intermittent events in chronological order. In checking protective devices in electricity supply systems, the pulse recorder picks up and plots the status of relays and contactors. It is also well suited to measuring relay switching times and to recording signals in electronic controls.

It can be used for monitoring and for locating faults in automated systems, as well as for recording events in power installations, industrial plants and in energy management systems.

For further information circle 215 on the reader service coupon or contact Siemens Power Plant Automation, 544 Church Street, Richmond 3121; phone (03) 420 7449.

Low cost line filters

Jaycar Electronics has added to its range two new in-line mains filter units, designed to provide a high level of protection against mains-borne interference, at low cost. The smaller MS-4000 unit provides basic transient protection (40J 8/20us), and sells for $27.95, while the larger MS-4002 unit adds a two stage EMI/RFI filter, and sells for $79.95. Both are approved to AS3100 and AS3105. ❖

For a wider choice of power supplies...

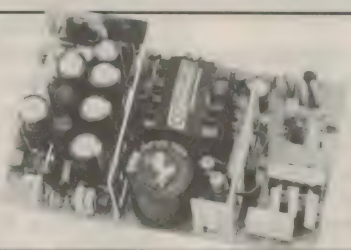
Amtex brings you the world-famous, internationally proven 'Computer Products' range of power supplies – a leader in the field since 1968.

Our Ex-Stock range of around 60 compact models makes it easy for you to specify the most efficient, most cost-effective solution for your power conversion needs.

Quality and reliability are outstanding, as all units are made to the most advanced designs, thoroughly computer tested, then individually burnt in.

Here are a few of our most popular models:

Universal Input (90-264VAC) 25W-75W



- MTBF > 100,000 hours
- Single output versions available on NFS40 series

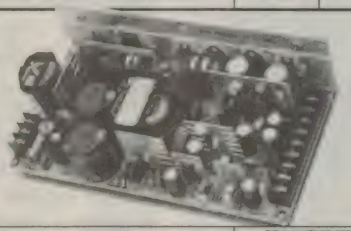
Model	Output Voltage & Max. Current	Max. O/P Watt	
		Free Air	Forced Air
NFS25-7608	+5.1V,2.0A; +12V,1.5A; −12V,0.2A	25W	–
NFS25-7628	+5.1V,2.0A; +12V, 0.2A; −12V,0.2A	25W	–
NFS40-7607	+5.1V,5.0A; +12V,2.0A; −5V, 0.5A	40W	50W
NFS40-7608	+5.1V,5.0A; +12V,2.0A; −12V,0.5A	40W	50W
NFS40-7610	+5.1V,5.0A; +15V,2.0A; −15V,0.5A	40W	50W
NFS40-7628	+5.1V,5.0A; +12V,0.5A; −12V,0.5A	40W	50W
NFS42-7608	+5.1V,3.5A; +12V,2.5A; −12V,0.3A	40W	–
NFS42-7610	+5.1V,3.5A; +15V,2.0A; −15V,0.3A	40W	–
NFS42-7627	+5.1V,3.5A; +24V,1.2A; −12V,0.3A	40W	–
NFS50-7608	+5.1V,7.0A; +12V,2.5A; −12V,0.7A	50W	60W
NFS75-7608	+5.0V,5.0A; +12V,3.0A; −12V,1.0A	75W	–

DC-DC Converter

(S) = Single output
(D) = Dual output
(T) = Triple output

Series	Input Voltage	Output Voltage	Max Output Power	Size L x W x H mm
PM600	5V; 12V	5V,0.1A/12V,0.08A(S)	1W	32 x 20 x 10
PM600	5V; 12V	±12V,.04A/±15V,.033A(D)	1W	32 x 20 x 10
A	5v; 12V; 24V; 48V	±12V,0.15A/±15V,0.15A(D)	4.5W	51 x 51 x 10
F	5V; 12V; 48V	5V,1A/12V,0.5A/15V,0.35A(S)	6W	51 x 51 x 10
AFC5	5V; 12V;	5V,1A/12V,0.4A/15V,0.35A(S)	5W	51 x 26 x 10
AFC5	5V; 12V	±12V,0.15A/±15V,0.15A/(D)	5W	51 x 26 x 10
PM900	5V; 12V; 24V; 48V	5V,1A/±12V,0.23A	5.5W	51 x 51 x 10
PM900	5V; 12V;	15V,0.4A/±15V,0.19A	6W	51 x 51 x 10
NFC40	24V; 48V	5V,8A/12V,3.5A/15V,2.8A(S)	40W	56 x 56 x 21
NFC40	24V; 48V	5V,7.5A; ±12V,0.75A(T)	40W	56 x 56 x 21
NFC40	24V; 48V	5V,7.5A; ±15V,0.75A(T)	40W	56 x 56 x 21

Universal Input (90-264VAC) 80W-350W



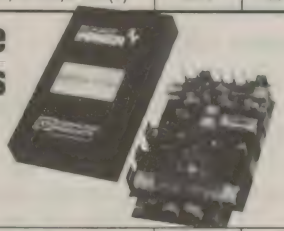
- MTBF > 65,000 hours
- Single output versions available on NFS110 series

Model	Output Voltage & Max. Current	Max. O/P Watt	
		Free Air	Forced Air
NFS80-7602	+5.0V,12A; +24V,2.5A; +12V,3A; −12V,3A	80W	110W
NFS80-7606	+5.0V,12A; +24V,2.5A; +15V,3A; −15V,3A	80W	110W
NFS110-7601P	+5.1V,10A; +12V,5.0A; −12V,1A; −5.0V,1A	80W	110W
NFS110-7602P	+5.1V,10A; +24V,4.5A; +12V,5A; −12V,1A	80W	110W
NFS110-7604P	+5.1V,10A; +15V,5.0A; −15V,1A; −5.0V,1A	80W	110W
NFS200-7601	+5.1V,30A; +12V,8.0A; −12V,4A; −5.2V,6A	–	200W
NFS200-7602	+5.1V,30A; +12V,8.0A; −12V,4A; 24V,3A	–	200W
NFS200-7603	+5.1V,30A; +12V,8.0A; −12V,4A; 12V,4A	–	200W
NFS200-7608	+5.1V,30A; +12V,8.0A; −12V,4A	–	200W
NFS350-7608	+5.1V,50A; +12V,12A; −12V,5A	–	350W
NFS350-7625	+5.1V,50A; +12V,12A; −12V,5A; (Note 1)	–	350W
NFS350-7626	+5.1V,50A; +12V,12A; −12V,5A; (Note 2)	–	350W

Note 1: 4th floating output is adjustable 4.5V-16.5V, 4A
Note 2: 4th floating output is adjustable 15V-30V, 4A
*Absence of "+" or "−" indicates a floating output

Wide Input Range DC-DC Converters

(S) = Single output
(D) = Dual output
(T) = Triple output



Series	Input Voltage	Output Voltage	Max Output Power	Size L x W x H mm
DR	18-36V	5V,0.5A/12V,0.25A(S)	2.5W	32 x 20 x 13
DR	18-36V; 36-72V	±12V,0.125A/±15V,0.1A(D)	3W	32 x 20 x 13
FW	36-72V	5V,1.5A/12V,0.625A(S)	7.5W	51 x 51 x 10
FW	36-72V	±12V,0.315A/±15V,0.25A(D)	7.5W	51 x 51 x 10
NFC15	20-72V	5V,3A/12V,1.25A/15V,1A(S)	15W	51 x 41 x 12
NFC15	20-72V	±12V,0.625A/±15V,0.5A(D)	15W	51 x 41 x 12
ES	18-36V; 36-72V	+5V,1.5A; ±12V,0.31A(T)	15W	76 x 66 x 21
ES	18-36V; 36-72V	+5V,1.5A; ±15V,0.25A(T)	15W	76 x 66 x 21
NFC25	36-72V	+5V,5A; ±12V,1.0A(T)	25W	76 x 76 x 10
NFC25	36-72V	+5V,5A; ±15V,0.8A(T)	25W	76 x 76 x 10
WRU	36-72V	+5V,5A/12V,2.5A/15V,2A(S)	30W	116 x 66 x 21
WRU	18-36V; 36-72V	±12V,1.25A/±15V,1A(D)	30W	116 x 66 x 21
WRK	18-36V; 36-72V	5V,10A/12V,5A(S)	60W	140 x 99 x 23
WRK	18-36V; 36-72V	+5V,5A; ±12V,1.25A(T)	55W	140 x 99 x 23
WRK	18-36V	+5V,5A/±15V,1A(T)	55W	140 x 99 x 23

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NEW PRODUCTS

Plain paper fax/printer

The many advantages of plain paper fax over thermal are by now widely recognised — plain paper is easier to write on and it won't curl or discolour with time. Ricoh is now introducing its fifth plain paper fax, the FAX800.

Designed to cater to the needs of low volume users who want the benefits of plain paper fax, but could previously only afford a thermal machine, the FAX800 is a compact, easy-to-use desktop model. It uses ink-jet recording on plain paper to produce copies of such a high quality that it can double as an ink-jet printer.

As a fax machine, the FAX800 is equipped with a 416KB memory capacity, which enables it to offer all the standard benefits of a Ricoh plain paper fax — including memory transmission, broadcasting, memory reception, substitute reception and ECM (error correction mode).

It also has a fax/tel auto change so that it can automatically distinguish between voice and fax calls, thus allowing the use of a single line for both telephone and fax/printer.

An added boon for home office users is the telephone answering machine interface, which lets the FAX800 switch voice calls to your answering machine if you are unable to answer them yourself.

Other benefits include: a Remote Diagnostic System which reduces machine downtime by enabling service engineers to attend to any problems from a remote control centre via a telephone line; and speedy 10s transmission, which means reduced communication costs.

For further information circle 241 on the reader service coupon or contact Inchcape Office Products, 128 Barcoo Street, East Roseville 2069; phone (02) 415 9444.

Cable adaptors, terminator plug

Dick Smith Electronics has recently added three handy items to its range of coaxial cable adaptors and fittings.

The P-2275 is a BNC 'T' adaptor, with two sockets and one plug, as used widely for 'daisy chain' connection of test instruments, computers and peripherals in Ethernet LANs, and so on. Of sturdy nickel-plated brass construction with gold-plated centre contacts, the adaptor is priced at $5.95.

The P-2471 is an adaptor which combines a BNC type socket with an N-series plug, and is thus suitable for many VHF/UHF applications including test instrumentation. This type of adaptor has not been widely available, and its addition to the range should be very welcome. Again it is of solid nickel-plated brass construction, with gold-plated centre contacts, and is priced at $8.95.

The P-2280 is a BNC plug with integral termination resistor, of nominal

50 ohms impedance. This makes it very suitable for termination of Ethernet LAN cable runs, and also as a low power dummy load in VHF test and measuring applications.

The construction is of nickel-plated brass, with a gold-plated centre pin and teflon/rubber gasket for durability and low SWR. The load resistor is fully shielded, and the impedance is stamped clearly on the back of the case. In short, a well made product and excellent value at $3.95.

All three of these new products are now available at Dick Smith Electronics outlets.

Real time 300MHz DSO

LeCroy's new 9361 is claimed to be the world's first 300MHz oscilloscope with sufficient sample rate to accurately characterise input signals up to the full bandwidth in real time.

This is achieved by digitising waveforms at 2.5GSps single-shot. The 8:1 ratio between maximum sample rate and highest bandwidth means all signals, right up to the scope's bandwidth, are accurately represented.

Other 300MHz scopes capture only a few samples per period in real time, or have slower digitisers which use repetitive sampling techniques to view signals. This requires hundreds of repetitions of the input signal for each displayed waveform.

The 9361, by comparison, displays the incoming waveform each time it occurs. For this reason, it is considered a 'real-time' digital oscilloscope.

The 9361 features two independent digitisers running simultaneously at up to 2.5GSps. Thus there are no compromises between digitising speed and the number of channels viewed. This makes the instrument ideal for digital design and debug, where fast single-shot channel-to-channel timing measurements are crucial.

'Smart' trigger functions include glitch, pulse width, interval width, state or edge-qualified, dropout and TV triggering. Variable holdoff by time or by number of events is also possible. On screen trigger icons indicate the trigger setup at a glance.

The 9361 is fully programmable via GPIB and RS-232C interfaces, which are provided as standard. Optional interfaces include Centronics and the industry-standard PCMCIA (Personal Computer Memory Card Interface Association) 68-pin interface for IC memory cards. These permit high speed storage of acquired signals, and offer densities of up to 4MB.

An internal 3.5" floppy disk drive permits the storage of waveforms or instrument setups.

For further information circle 242 on the reader service coupon or contact Scientific Devices Australia, 2 Jacks Road, South Oakleigh 3167; phone (03) 579 3622, fax 579 0971.

SMD trimmer for auto adjustment

Murata Manufacturing has released the RVG3A08 series 3mm square SMD trimmer potentiometer, which can be automatically adjusted. By incorporating a coneshaped knob onto the wiper, Murata has succeeded in developing an SMD trimmer potentiometer with only three components.

In addition, a special screwdriver bit that ensures precise automatic adjustment is also available. This bit can be easily and accurately introduced into the adjustment slot, even when the position of the product is offset by +/-0.7mm, vertically or horizontally.

This allows automatic adjustment to be performed without the necessity of image processing or similar complex techniques for locating the adjustment slot. The RVG3A08 series is available in a resistance range of 200 ohms to 2M, one, two, three and five values per decade, with linear taper and power rating of 0.1W 70°C.

The maximum operating voltage is 50V DC, operating temperature -55°C to +125°C, rotation torque 2.0 to 24.5mN-m, and effective rotation angle is 270°+/-10%.

For further information circle 248 on the reader service coupon or contact IRH Components, 1-5 Carter Street, Lidcombe 2141; phone (02) 364 1766, fax 647 1545.

Instrument carts

Tektronix has introduced a new family of six instrument carts. The new ergonomically designed carts bring a higher level of functionality to the end user, while increasing work space efficiency. The sturdy construction of the new Lab Carts let you safely and easily move expensive lab instruments for equipment sharing.

The contemporary-looking high tech carts are constructed of extruded aircraft aluminium, with twice the weight capacity of existing carts. Large smooth rolling 100mm dual durometer, twin wheel casters provide quiet, shock absorbing transport. Two of the casters have positive locking action to securely position the car when and where you place it. Three of the carts, (K415, K417 and K420), come with soft foam handles for tactile fit and hold. Ovaloid, black plastic knobs used on the tilt shelves make shelf adjustment easy. Reverse cradles enable instruments to be positioned on the cart without any obstructions. The new carts can be custom configured to meet specific customer requirements.

For further information circle 246 on the reader service coupon or contact Tektronix Australia, 80 Waterloo Road, North Ryde 2113; phone (02) 888 7066, fax 888 0125.

Clamp-on multimeter

Unihall-1000 is a compact clamp-on digital multimeter — a hand-held instrument capable of measuring six different electrical parameters without the need to break the current circuit.

Measured functions include: RMS AC/DC voltage and current; true and apparent power; power factor; and frequency. The measured value, together with its corresponding engineering unit, is displayed on a 3.5 digit LCD.

True RMS measurements are accurate, almost regardless of the shape of the waveform, to a crest factor of seven. In addition to the display, an analog output of the measured current value can be measured on an oscilloscope, or sent to a recorder or other measuring instrument. Either true RMS or instantaneous value can be selected for the analog output.

For further information circle 245 on the reader service coupon or contact AWA Distribution, 112-118 Talavera Road, North Ryde 2113; phone (02) 888 9000, fax 888 9310.

Programmable transponder

Texas Instruments TIRIS has released a 'breakthrough' addition to its line of low frequency, passive, read/write transponders, with more than 1000 bits of memory, which can be selectively programmed and read.

It is particularly suited to any application where a basic identification is required, with data added as the product proceeds through production or distribution — anything that could use an RF identification tag as a 'data carrier', while building up a record of information in successive steps.

The memory is partitioned into several 64-bit 'pages', which can be addressed individually. Data can be written to a given page without disturbing other pages, and the time it takes to program an identification tag is greatly reduced.

The tags are available in four, eight and 16-page versions and in all standard TIRIS transponder configurations — glass capsule, ID card, and rugged packaging for vehicle ID. Page 1 contains a factory programmed, read-only code that acts as a permanent, tamper proof, ID number for the tagged object. In addition, the user programmable pages can also be irreversibly locked to 'read only'.

All TIRIS low frequency transponders are fully compatible, can be read from distances up to 3m (depending upon the antenna used) and while moving and can be reprogrammed thousands of times.

For further information circle 250 on the reader service coupon or contact TIRIS Application Centre, Texas Instruments, 171 Philip Highway, Elizabeth 5112; phone (08) 255 2066.

Memory card connectors

Utilux is now able to offer a full range of Molex memory card connectors and kits, with industry standard compatibility. This increasing range of products include 68 circuit receptacles and headers which meet PCMCIA standards for Type I, II or Type III card applications. The headers and receptacles also meet JEIDA standards for DRAM card applications.

For further information circle 243 on the reader service coupon or contact Utilux, PO Box 68, Kingsgrove 2208; phone (02) 50 0155, fax 502 1753.

Low cost 15MHz arb/function gen

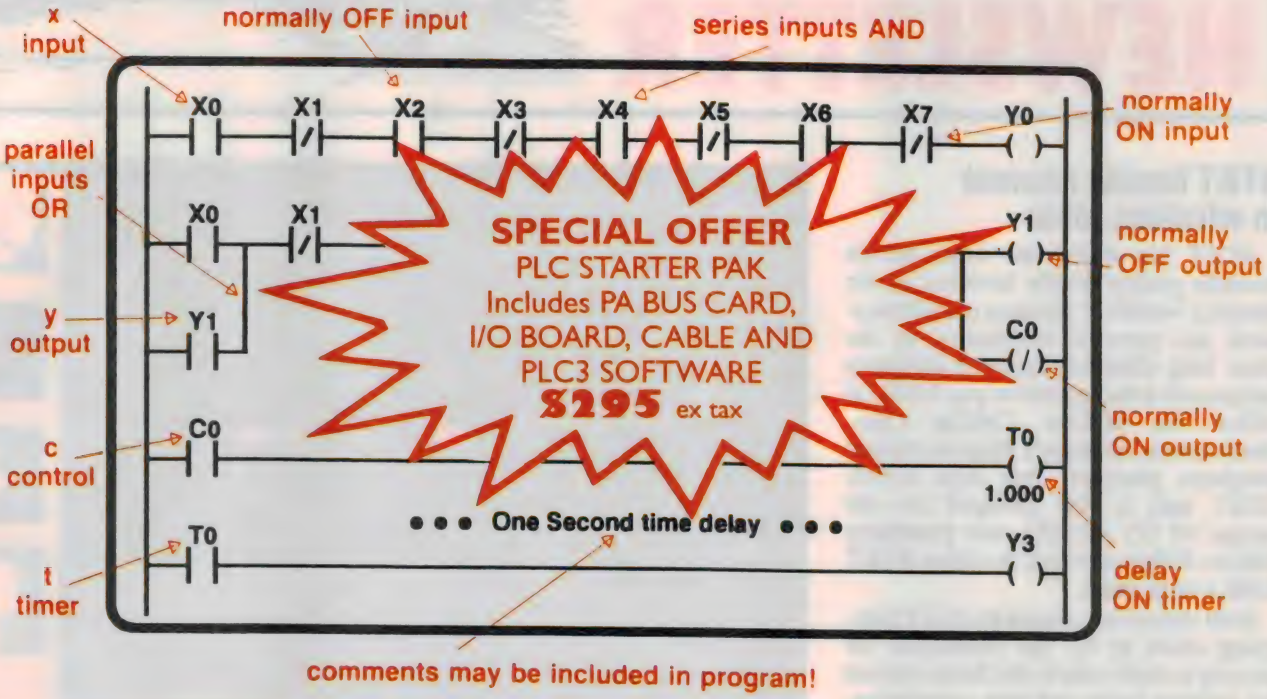
Hewlett-Packard has just released a new fully programmable 15MHz function/arbitrary waveform generator, the HP 33120A, which provides digitally synthesised signals of 12-bit resolution.

The HP 33120A uses DDS technology to produce stable, accurately defined waveforms including low-distortion sinewaves, fast rise and fall-time squarewaves and linear triangle and ramp waveforms with a resolution of 10uHz. For arbitrary waveform generation it has a waveform length of 16K 12-bit samples with a maximum sampling rate of 40MSps. Up to four 16K waveforms or eight 8K waveforms can be stored in non-volatile memory. All waveforms can be internally modulated with AM, FM, FSK or burst, and both linear and log sweeps are available at rates from 1ms to 500s.

Optional Benchlink software allows the generator to be programmed from a PC, using either of the built-in RS-232C or HPIB interfaces.

The Australian price of the HP 33120A is $2877 (ex tax). Further information is available from a lady called Toula, in H-P Australia's Customer Information Centre — call her on 13 1347. ❖

DISCOVER PROGRAMMABLE CONTROL!



EXTENDED VERSION OUT NOW! CONTROLS 128 INPUTS AND 120 OUTPUTS

Programmable control from your IBM-PC or compatible? Imagine being able to write and test logic control programs as easily as switching on a light bulb. Procon Technology has done just that with its PLC version 3.0 software. This program provides a relay ladder logic style of programming - shown above - that's easy to learn and easy to understand. What's more, it's the style of language used in multitudes of industrial controllers worldwide!

Together with our I/O board, this software turns your PC at home or in the office, school or laboratory into a powerful, yet flexible, programmable controller. Your computer becomes the centre of the control system – it monitors the inputs, scans and solves logic and performs other special functions to determine and set the output conditions.

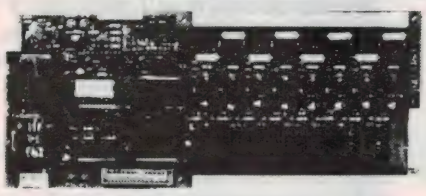
The PLC editor facilitates the entering, deleting and altering of comments and ladders off-line or on-line. On-line editing allows modifications to be made to the program without disruption to the control operations. E.g. You could adjust a time delay, correct a logic error or add more functions whilst the program continues to run – uninterrupted.

Unlike other programming languages, PLC version 3.0 also provides real-time indication of logic conditions continuously on the screen – again with no interruption to program execution. Each closed contact or activated output is highlighted on the screen and each timer's remaining duration is displayed. Monitoring and debugging control programs couldn't be easier!

Once a program has been debugged, it can then be loaded for execution in background whilst the computer is used for other things (such as word-processing or spreadsheets).

With additional I/O boards, numerous PLC application programs may run in the background providing an economical means of controlling many different items of equipment.

Applications include: Home or business automation and security systems, model control, laboratory automation and educational and training needs.



The NR-12VAC I/O board is mounted externally (up to 30 metres from the computer) and provides 8 isolated 12 Volt AC or DC inputs and 8 independent relay outputs. LED indication is provided on all inputs and outputs and all connections are via screw terminals. The system is capable of expanding to 240 I/O from one PA-BUS card inserted into a single card slot in the computer.

Other I/O options are available, including an industrial version. The I/O boards may also be controlled from other high-level languages.

VISA, BC, MC accepted.

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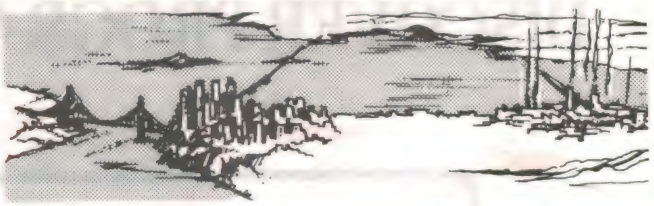


AT&T boosts interest in wireless, data

AT&T has made two more moves towards getting deeply involved in the merging worlds of wireless communications and personal computing, as the giant long distance telephone company announced it had agreed to pay US$12.6 billion for McCaw Cellular Communications, America's biggest cellular telephone provider. Two days earlier, AT&T said it had arranged for the merger of EO and GO, two promising Silicon Valley start-ups in which AT&T holds a large stake.

Both moves are related to AT&T's ongoing effort to lay the foundation for playing a major role in the future market for wireless voice and data communications, which is rapidly developing around a new generation of devices that combine communications and computing features — such as the Personal Communicator from EO and the Newton from Apple.

The cellular communications network is quickly becoming the medium of choice for various forms of wireless communications, including voice, two way paging, mobile fax, e-mail and other computer data transmission.

Beside providing the cellular medium AT&T is also determined to supply much of the hardware and software that will drive these new markets.

EO's palm-size pen computer already integrates personal computer functions with wireless communications capabilities. GO, on the other hand, is trying to become the leading vendor of pen based operating system software, the kind of software that may well become the most common system software in the wireless computing world.

Besides investing in EO and GO, AT&T also has large stakes in 3DO, which is developing an advanced interactive home video entertainment system and operating software, as well as a large chunk of General Manager, the consortium formed last year to develop a programming language for wireless communications.

And finally, AT&T has been developing a line of 'Hobbit' RISC processors, designed specifically for high level multimedia system development.

One of the fastest growing segments of the US electronics and information technology industries is video games, and game developers are establishing more and more links with Hollywood movie producers. Software maker Spectrum Holobyte is working with Paramount to develop game based on the movie 'Star Trek: The Next Generation', with scenes like that shown here.

Sumitomo calms chip shortage fears

In a move that will hopefully avoid the possibility of a worldwide crisis in the semiconductor industry, Sumitomo of Japan has announced its decision to re-open the badly damaged factory that had been producing 60% of the world's supply of a critical chip packaging material. Sumitomo said it has proven easier than expected to rebuild the facility.

Earlier, widespread reports had indicated that Sumitomo had decided to get out of the epoxy resin business after its facility was virtually destroyed by an explosion and fire on July 4.

According to some reports, Sumitomo has been negotiating with Dow Chemical and other companies to licence its epoxy resin production process instead of trying to rebuild its own plant.

Fear that a shortage of the chip packaging material could bring production of high volume chips such as DRAMs to a halt has sent DRAM prices skyrocketing on the open market. The Sumitomo decision to rebuild the plant will likely end the panic buying and allow prices to return to close to the level they were at prior to the blast.

Sumitomo said it will open one of two new epoxy resin production lines as early as December at its Nihama factory complex. Government approval for the plans is expected within a week.

Industry observers speculate that Sumitomo officials may have been put under some pressure from Japan's semiconductor industry to quickly rebuild its epoxy resin capability.

Besides the devastating effects on their sales in the event of a shortage

of packaging material, Japan's industry was facing the possibility that dominance of the epoxy resin market would shift to the United States if Dow took over Sumitomo's production process.

Rock leaves Apple board

Citing a conflict of interest, famous venture capitalist Arthur Rock has announced his resignation from Apple Computer's board of directors.

Rock has been a member of the board since the early 1970's, when he was part of a small group of investors that put up the first round of venture capital for Steve Jobs and Steve Wozniak to put their Apple 1 computer into production.

Rock said the main reason for his decision to leave was because of a growing conflict of interest between sitting on the boards of directors of both Apple and Intel, another company for which he provided a large portion of the initial funding resources.

The conflict of interest stems from Apple's partnership with IBM and Motorola in the development of the PowerPC RISC processor, a chip that Motorola is positioning as a major competitor of Intel's Pentium processor. Particularly now that Motorola and Microsoft have decided to make the PowerPC run the NT operating system, a head-on battle between Intel and Motorola is inevitable.

Rock's departure comes at a difficult time for Apple, which is struggling to catch up to the rest of the personal computer industry in terms of slashing prices and restructuring its operations to trim fat and luxuries that companies can no longer afford in the cut throat PC market.

Rock said his departure has nothing to do with Apple's recent problems. "I would have stayed on Apple's board if it had not been for this problem," he said referring to the PowerPC issue. But I think in a case like this it is sometimes better to be like Caesar's wife.

Apple chairman John Sculley praised Rock. "Arthur has brought a steady hand to Apple during a period of growth and change. He has our thanks and best wishes."

US to subsidise chip research

The US Commerce Department has developed a new high tech industrial policy aimed at helping critical industries develop products that will compete effectively on world markets.

While remaining opposed to implementing tariffs and other protectionist measures, the Commerce Department is planning to subsidise some of the research being conducted by US semiconductor companies trying to develop new generation chip products.

One official in the Clinton Administration told reporters that while the loss of certain chip markets does not pose a threat to US national security, the new government wants to improve the chances of the domestic industry remaining competitive in such markets.

The DoC's research assistance program is based on the ability of the DoC to use its own resources and discretions to fund a number of chip research projects which have the potential of creating new jobs, both by the chip companies that will be making the devices and by the companies that will be using the devices in new end user products. The DoC won't need Congressional approval for any individual subsidies it deems appropriate.

One of the first investments being considered involves several US companies that are making ceramic chip packages which incorporate implanted metal connector circuitry.

The market is 90% controlled by Japanese companies. Kyocera, alone, has a 50% share of the world market for these ceramic packages.

Last year, two small US firms filed a petition with the US government under a recent new law that would allow the President to take protectionist measures to protect an industry vital to US national security.

In their petition, the firms cited military dependence on ceramic chips in defence/aerospace systems.

US Government must preserve E-Mail

For more than 20 years, US government regulations have mandated that government agencies maintain records of all intra-agency and inter-agency memos and other correspondence. Recently, in a ruling that shows how much of an impact electronic mail already has made on today's market place, a Federal Court of Appeals in Washington DC ruled that e-mail messages will have to be preserved in similar fashion.

The three-judge Court of Appeals rejected arguments presented by the Clinton Administration that e-mail messages between government officials did not have to be preserved.

The Administration had argued that individual government officials and departments should have the right to decide which computer messages they wanted to save, by printing them out on paper for storage purposes. But the judges said that electronic mail has fast become the preferred method of communications between government officials and departments.

E-mail, the judges noted was used extensively by the Justice Department in prosecuting deposed Panama leader Manuel Noriega, as well as by the special prosecutor in the Iran-Contra affair.

The Court said the government must store all e-mail messages in their original form, not just the paper printouts. Historians, journalists and freedom of information supporters hailed the unanimous decision, which they said recognises that much of the government's business is being conducted on computers.

Preserving these records is essential in ensuring that historians will be able to have access to the complete records of government action.

Lotus closer to win from Borland

In a ruling that is likely to result in the award of tens of millions of dollars in damages, Borland International lost a key ruling in the three year old court battle between Lotus and Borland over the alleged illegal use of Lotus 1-2-3 look and feel features in Borland's Quattro Pro spreadsheet programs.

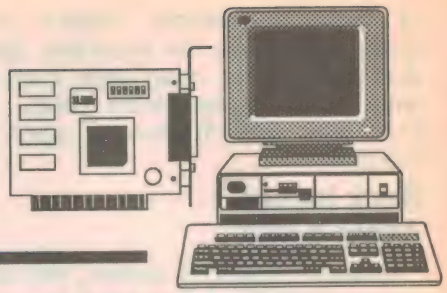
A Federal District Court Judge in Boston ruled that elements of Borland's Quattro Pro programe violated some of Lotus' 1-2-3 copyrights. As a result of that ruling, Lotus is free to seek damages from Borland in a jury trial and ask the court to impose an injunction against Borland barring the company from further marketing its product.

Anticipating a loss in court, Borland has reportedly initiated a program aimed at raising between US$50 and $100 million, as the damage award may well exceed US$100 million according to some industry analysts.

The ruling could force Borland to remove or dramatically change the macros in Quattro Prof. That means users familiar with working in 1-2-3 will not be able to switch as easily to Quattro Pro, as they will have to get used to the different ways in which future versions of Quattro Pro operate and interface with the user.

The ruling is unlikely to have an immediate effect on Borland. A jury trial is at least a year away, and the inevitable appeals will add one or more years to the point where Borland could face penalties and injunctions. ❖

Computer News and New Products



Power saving monitors

NEC Home Electronics Australia has announced its innovative monitor power management feature, Intelligent Power Manager (IPM). From October 1993, MultiSync Business Series monitor models 4FGe and 5FGe sold in Australia will comply with the US Environmental Protection Agency's Energy Star Program for energy efficiency. This rating system requires all PCs and monitors to 'power down' to 30W or below, in order to be eligible for purchase by the US government.

As well, all NEC MultiSync monitors will comply with the VESA DPMS (Display Power Management Signalling) proposal, which is a draft standard applicable to video cards which subsequently 'drive' or control the monitor. The video card receives instructions from either an 'SL' type computer processor or from a software utility and then places the monitor in various sleep modes.

To help users work with larger monitors all day, NEC has implemented an Opti-Clear screen coating on its new 5FGp and 6FGp models. Similar to the highly specialised coatings laminated to the goggles and sunglasses of professional skiers, the MultiSync 5FGp and 6FGp colour monitors' coating eliminates glare and reflection and allows users to see the screen with greater clarity.

For further information circle 162 on the reader service coupon or contact NEC Home Electronics Australia, 24 Beecroft Road, Epping 2121; phone (02 868 1811, fax 869 1112.

Mini printer

Amtex Electronics has released a series of compact dot matrix impact printers. These stand-alone printers offer either a serial (RS-232) or parallel (Centronics) interface in a range of 16, 24, 40 and 42 columns.

The printers will deliver 4488 defined characters, including all 96 ASCII, plus Greek, German, Russian, French, Japanese and Chinese special chars, math symbols, printing symbols, block graphics, and 32 user-definable characters. The 35 control codes are IBM and Epson Esc-P compatible, and an input buffer of 512

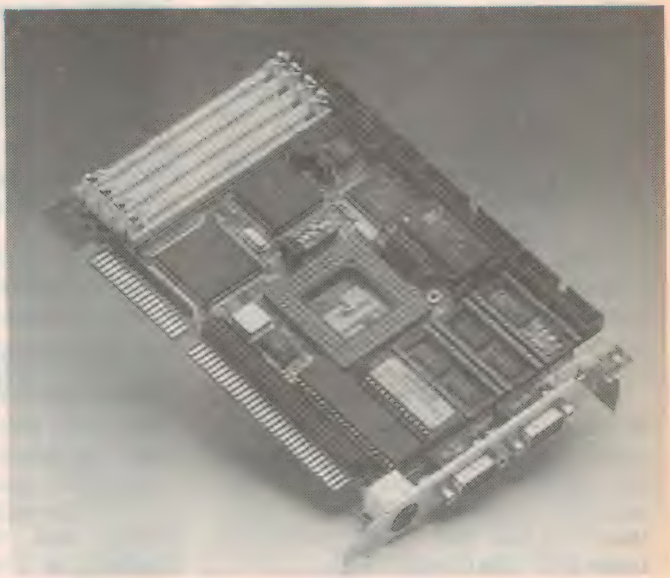
486 CPU card has Flash/ROM

The PCA-6143 half size all-in-one 486 CPU card with Flash/ROM disk has been developed to meet the demand for compact, flexible, high performance embedded computers.

It comes with either the 80486SX-25MHz, 80486DX-33, 80486DX2-50, or 80486DX2-66 processors.

This compact industrial CPU card requires only a single power supply voltage (+5V), and also provides a connector for an external supply. In addition to its RS-232 serial port, bi-directional parallel port, and IDE hard disk and floppy disk drive controllers, the PCA-6143 provides a range of special features for industrial and embedded applications.

The PCA-6143's built in Flash/ROM disk emulates a floppy disk drive, providing up to 1.44MB of write protected storage. Its RS-422/RS-485 port ensures high speed, low noise and long distance communication with remote control devices, instruments, data terminals and PLCs. Its four SIMM sockets provide system DRAM from one to 16MB; and a watchdog timer ensures continuous operation in unattended applications, resetting the CPU if it should come to a stop due to a software bug or EMI problem. In addition to the card's onboard capabilities, a 64-pin bus connector supports Advantech piggyback modules (such as the PCD-8931 Flash/RAM/ROM disk, or the PCA-6443 flat-panel/CRT VGA.



For further information circle 161 on the reader service coupon or contact Priority Electronics, 5/23 Melrose Street, Sandringham 3191; phone (03) 521 0266, phone 521 0356.

chars is provided. The mini printers are compact in size, measuring only 160 x 106 x 40mm (WxDxH), and weigh only 350g with an interior paper roll. A DC supply of 5V at 3A is required. The printer comes complete with printer cable, 5V power supply cable, testing paper (one roll), user manual and external paper stand. They are ideal for printing records for automatic test systems, medical instruments, receipt printing in stores, buses, parks, etc. Their light weight, compact size and low DC power requirement also makes them ideal for portable applications where a record or receipt is required.

For further information circle 163 on the reader service coupon or contact Amtex, PO Box 285, Chatswood 2057; phone (02) 805 0855, fax 805 0750.

Optical disk drive

The TEAC OD-6000 is a 5.25" optical disk drive with a high speed data transfer rate. Its advanced drive architecture features an embedded SCSI-2 interface, high output semiconductor technology, and high speed disk rotation, to enable an average access time of within 42ms and the high speed 5.3MB data transfer.

The drive needs no air filter, since it has a shield filter to prevent the dust in the air from coming into the drive mechanism, especially the optical head area. Fresh air drawn in from the front of the cabinet is channelled in and over the drive mechanism for efficient cooling.

ISO standard disks allow rewritable storage up to 127MB, and data exchange between a broad range of systems. The OD-6000 can read and/or write to O-ROM and partial ROM.

For further information circle 166 on the reader service coupon or contact AWA Distribution, 112-118 Talavera Road, North Ryde 2113; phone (02) 888 9000, fax 888 9310.

Colour version of digital camera

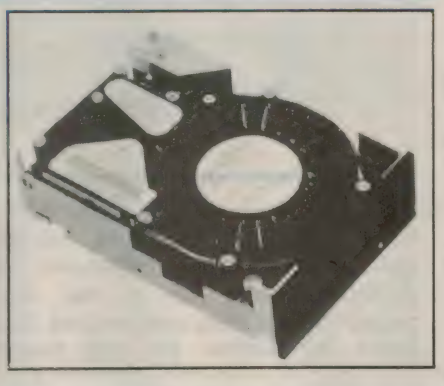
Dycam has announced a colour version of its grey scale Model 3 digital camera. The new Dycam Model 4 is a self contained pocket sized camera, which take 16 24-bit colour images, and stores and downloads to a wide variety of computer platforms, including PCs, Macintosh and Unix systems. The Model 4 comes with a complete suite of software for camera control, image manipulation and final editing. No further software is necessary to take and print high quality digital images.

The Model 4 attaches directly to the computer's serial I/O port for fast downloading of images taken in the field, or for camera reprogramming. Images are also available directly from the camera via modem for remote applications. Up to 16 images can be stored in the camera's memory for 100 hours before recharging

3.5" hard drive has 1.62GB capacity

Micropolis has introduced a 1.62 gigabyte 3.5 inch AT/IDE disk drive — which, according to them is the highest capacity IDE drive available on the market. Called the model 2217A, the new drive allows stand alone and networked PC users to increase the storage capacity of their systems to run disk-intensive applications, and is ideal for imaging graphics, multitasking operating systems and engineering design applications. It uses the existing IDE interface built into the computer, and so eliminates the expense of purchasing an adaptor card or interface board.

Software included with the drive overcomes the 528MB limitation of PC architecture when accessing the system's hard drive, permitting the computer to view the model 2217A drive as one single, logical volume of 1.62GB. For faster overall operation of the drive, the 2217A has a 180us command overhead, which is less than half the overhead of a typical SCSI drive. Its drive spins at 5400rpm, with the higher rotation speed



reducing latency, and allowing faster data access and data transfer rate. Other features of the model 2217A are its 10ms average seek time, and the onboard IDE controller, which permits a high speed data transfer rate of up to 5MBps. There are two additional drives in the 2200A IDE series, the 2210A, with a formatted capacity of 976MB, and the 2205A which features 542MB of user storage.

For further information circle 165 on the reader service coupon or contact Micropolis, 201 Miller Street, North Sydney 2060; phone (02) 959 2326, fax 959 2298.

is necessary. The inbuilt flash toggles on or off, and images are viewable on screen in 'real time' with the enclosed viewfinder software, for composing before final capture.

Unlike still video cameras, no frame grabber card is required in the PC, and there is no noisy A/D conversion since the image is digitised right at the lens. The image size is 496 x 365 pixels in true 24-bit digital colour. Images are exported and saved in a variety of graphic formats including TIFF, PCX, EPS, Compressed, Targa and BMP, and the imaging software enables full colour editing and print enhancement.

The Dycam Model 4 has a recommended retail price of $2586 (including tax). For further information circle 167 on the reader service coupon or contact Sprinter Products, 15 West Street, Brookvale 2100; phone (02) 938 3388, fax 938 3288.

Real time data acquisition

Microstar Laboratories has announced the DAP 3200e, a data acquisition board that includes its own dedicated 80486 processor. This processing power gives the DAP 3200e unprecedented real time response with a task latency of less than half a millisecond.

As well as the 486 processor, the board includes either 1MB or 4MB of onboard memory, and its own multitasking real time operating system, DAPL 4.0. It can therefore handle all the critical real time aspects of a data acquisition and control system with all its associated analog and digital I/O, while leaving the processor on the PC platform — another 486, say — free to handle the demands of a resource-hungry operating system and user interface.

A single DAP 3200e — with external expansion hardware — can acquire up to 512 analog inputs and 128 digital inputs, can process the acquired data, and can update up to 66 analog outputs and 128 digital outputs. It has a real time processing capability, synchronised on a single PC platform and with overall mixed analog and digital sampling of over 4MSps.

For more information circle 175 on the reader service coupon or contact Mycon Technology, PO Box 211, Heidelberg 3084; phone (03) 499 2607. ❖

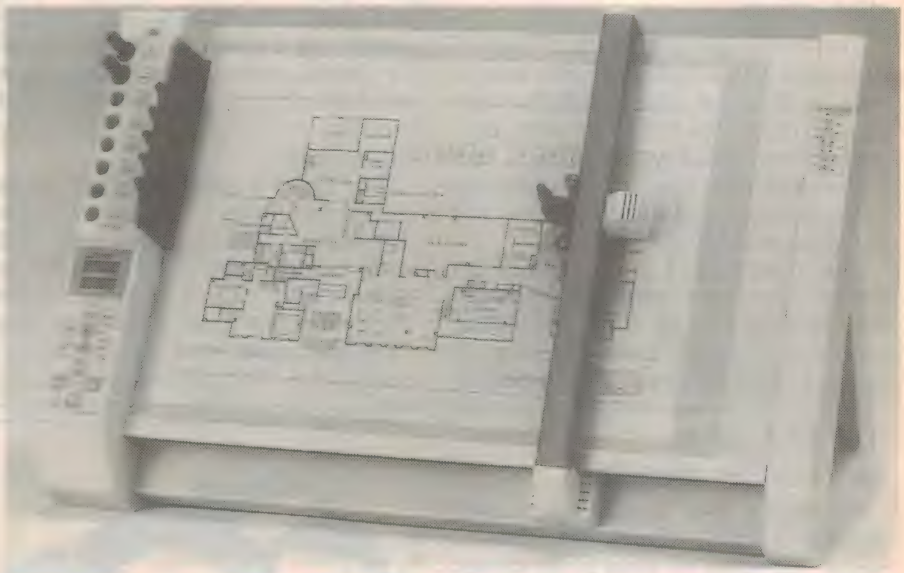
A3 2000dpi desktop plotter

Roland Digital Group has released its latest DXY A3, eight-pen flatbed range of pen plotters. Compared with the 360 and 400dpi resolution for A4 and A3 plotter.printing devices, the Roland DXY desktop plotters are capable of an 'effective dpi' value of 2000 plus. Couple this with the fact that it is an eight-colour output device, and it is not hard to see why, at around $1600, these reliable little A3/A4 workhorses are still selling well.

The new DXY series of A3 eight-pen plotters was designed for precision, with a highly accurate mechanical resolution. DXY plotters also come standard with quality accessories, including ceramic tip pens that ensure outstanding line quality every time.

The series features auto-protocol, which allows the plotter to automatically determine whether the incoming data is serial or parallel, and configure itself accordingly. This removes the need to manually set the DIP switches. The DXY also has an auto-scaling function that reduces wide format designs to ISO A3 (ANSI B) size drawings which is particularly valuable for quick check plots. It can also be equipped with an optional cutting blade, that lets you create vinyl signs and labels direct from your computer. With this cutting option, the DXY is transformed into a full featured graphics machine, especially useful for signmakers.

For further information circle 168 on the reader service coupon or contact Roland Digital Group, 573 Church Street, Richmond 3121; phone (03) 428 1088.



EA DIRECTORY OF SUPPLIERS

Which of our many advertisers are most likely to be able to sell you that special component, instrument, kit or tool? It's not always easy to decide, because they can't advertise all of their product lines each month. Also some are wholesalers and don't sell to the public. The table below is published as a special service to EA readers, as a guide to the main products sold by our retail advertisers. For address information see the advertisements in this or other recent issues.

Supplier	State	A	B	C	D	E	F	G
Altronics	WA	•	•	•	•	•	•	•
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TECS	VIC	•	•	•	•	•	•	•
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KEY TO CODING:
A Kits and modules
B Tools
C PC boards and supplies
D Components
E IC chips and semiconductors
F Test and measuring instruments
G Reference books

Note that the above list is based on our understanding of the products sold by the firms concerned. If there are any errors or omissions, please let us know.

Electronics Australia Reader Services

SUBSCRIPTIONS: All subscription enquiries should be directed to: Subscriptions Department, Federal Publishing Co, PO Box 199, Alexandria 2015; phone (02) 353 9944.
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PHOTOSTAT COPIES: When back issues are exhausted, photocopies of articles can be supplied. Price $7.50 per project or $15 where a project spreads over several issues.
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PROJECT QUERIES: Advice on projects is limited to postal correspondence only and to projects less than five years old. Price $7.50. Please note that we cannot undertake special research or advise on project modifications.
Members of our technical staff are not available to discuss technical problems by telephone.
OTHER QUERIES: Technical queries outside the scope of 'Replies by Post', or submitted without fee, may be answered in the 'Information Centre' pages at the discretion of the Editor.
PAYMENT: Must be negotiable in Australia and payable to 'Electronics Australia'. Send cheque, money order or credit card number (American Express, Bankcard, Mastercard or Visa card), name and address (see form).
ADDRESS: Send all correspondence to: The Secretary, Electronics Australia, P.O. Box 199, Alexandria, NSW 2015; phone (02) 353 0620.
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ADVERTISING INDEX

This index is provided as an additional service. The publisher does not assume any liability for errors or omissions.

FM TRANSMITTER MK1 KIT

This unit has most of the features of our previously advertised FMTXMK2 transmitter, but is much, much smaller. The complete transmitter PCB (Miniature microphone included) is the size of a "AA" battery, and it is powered by a single "AA" battery. We use a two "AA" battery holder (provided) for the case, and a battery clip (Switch) for the switch. Estimated battery life is over 500 hours!! SAME PRICE AS OUR FMTXMK2:

$11 ea or 3 for $30

LASER POINTER

When this magazine goes to print we will have in stock a very small 5mW-670nM laser diode based pointer. This pointer actually uses a 5mW laser diode: Very bright! Do not be misled by advertisements that advertise pointers with a power output of 5mW maximum, as these could have a power output of as little as 1mW. The SPECIAL introductory price for our pointer is an all time low:

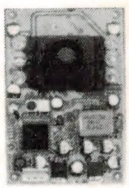
$139

APC VISIBLE LASER DIODE KIT

Our best visible laser diode kit ever! This one is supplied with a 5mW-670nM diode and the lens already mounted in a small brass assembly, which has the three connecting wires attached. The lens used is the most efficient we have seen, and its focus can be adjusted. We also provide a PCB and all onboard components kit for a driver kit that features Automatic Power Control (APC). Head has a diameter of 11mm and is 22mm long, APC driver PCB is 20 x 23mm, 4.5-12V operation at approx 80mA.

$85

MINIATURE CCD CAMERA



A monochrome CCD Camera that is totally assembled on a small PCB and includes an Auto Iris lens: Overall dimensions of camera are 24 X 54 X 120mm. The camera can work with as little as 0.1 lux illumination, and it is IR responsive! The six IR leds that are included on the PC.B. are useful for producing good images in a totally dark room! Available in EIA or CCIR standards.

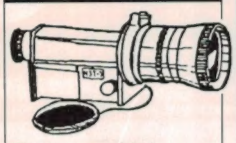
$199

VOICE RECORDING MODULES

These "State of the art" solid state voice recording modules can record and play back messages up to 20 seconds long. They are very small and produce good quality sound. Include PCB assembly, microphone, speaker and a battery holder. INCREDIBLE PRODUCT AT ONLY:

$25

PASSIVE NIGHT VIEWER



This is a completed commercial monocular hand held night viewer, that employs an image intensifier tube: Luminous gain of 12500! The viewer is of a USSR military standard, and will produce useful images in as little as starlight illumination. Has adjustable low light objective lens, adjustable eyepiece, and is supplied with a carry case. Limited supplies at an incredible price of:

$799

PRECISION STEPPER MOTOR

This precision 4 wire Japanese stepper motor has 1.8 degree steps: That is 200 steps per revolution! 56mm diameter, 40mm high, drive shaft has a diameter of 6mm and is 20mm long, 7.2V-0.6A DC. We have a good, but LIMITED supply of these brand new motors:

$20

9" AMBER MONITOR

These are non enclosed composite monitors that can be powered from a 12V D.C. supply.

$60

IR LASER DIODE SPECIAL

If you have never experimented with laser diodes, don't miss out on this SPECIAL. We supply a brand new 780nM LASER DIODE (Barely visible) with small plastic COLLIMATING LENS to suit, a HEATSINK for the diode, a PCB and components kit for a suitable CONTANT CURRENT DRIVER, a suitable PIN DIODE that can serve as a detector, plus some INSTRUCTIONS. Suitable for medical use, perimeter protection, data transmission, IR illumination, etc. Experimenters delight at a SPECIAL PRICE OF ONLY:

$30

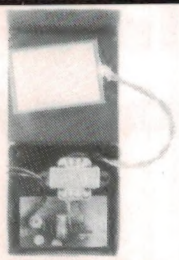
UNINTERRUPTABLE POWER SUPPLY (UPS)

THESE ARE VERY COMPACT, HIGH QUALITY, UPS's. They feature a 300W-450W **SINE WAVE INVERTER.** The inverter is powered by two series 12V-6.5AHr. (24V). batteries that are built into the unit. **There is only one catch:** Because these NEW units have been in storage for a while, we cannot guarantee the two batteries for any period of time, but we will guarantee that the batteries will perform in the UPS's when these are supplied. We will provide a three month warranty on the UPS's, but not on the batteries. A circuit will also be provided. **PRICED AT FRACTION OF THEIR REAL VALUE: BE QUICK!**

$299

We may also have some similar 600 Watt UPS's available: Similar story. New 6.5 AHr. batteries: $35 ea. Freight charge: $15 per UPS.

BACKLIGHTING INVERTER KIT



This kit inverter can power all the Fluorescent screens that are supplied as an option with many LCD displays. 5-12V operation with adjustable output power for different screen powers — brightness. A 60 X 45mm fluorescent screen and a plastic case will be supplied for FREE with each kit. When powered by the inverter this screen will light a brilliant white whilst the inverter only draws 100mA from the battery: Very efficient small fluorescent light! Experimenters delight at only:

$12

For the inverter kit and one screen. Additional screens $3 ea.

PLASMA BALL KIT

This kit will produce a fascinating colourful changing high voltage discharge in a standard domestic light bulb. The EHT circuit is powered from a 12V supply and draws a low 0.7A. We provide a solder masked and screened PCB, all the onboard components (Flyback transformer included), and the instructions at a SPECIAL introductory price of:

$29

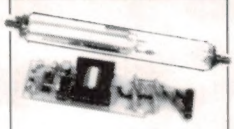
We do not supply the standard light bulb or any casing. The prototype supply was housed in a large Coffee jar, with the lamp mounted on the lid: A very attractive low cost housing!! Diagrams included.

IR VIEWER "TANK SET"

ON SPECIAL is a set of components that can be used to make a complete first generation Infra Red night viewer. These matching lenses tubes and eyepieces were removed from working tank viewers, and we also supply a suitable EHT power supply for the particular tube supplied. This power supply may be ready made or in kit form: Basic instructions provided. The resultant viewer requires IR illumination.

$150-$200

12V OPERATED LASER



This combination includes one used 3mW SIEMENS visible red laser tube and one 12V Universal Laser power supply MKIII kit. The inverter is easy to construct since it is supplied with a prewound transformer, and solder masked and screened PCB.

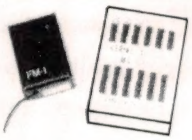
$89

INDUCTIVE PROXIMITY SWITCHES

These industrial quality detectors will detect ferrous and non-ferrous metals at close proximity. Some are DC powered (10-30V), some are mains AC powered, and all will switch loads directly. All have three wires for connecting into circuitry: Two for the supply, and one for switching the load. These also make excellent sensors for rotating shafts etc. LIMITED SUPPLIES. ON SPECIAL AT:

$22 ea. or 6 for $100

MINIATURE FM TRANSMITTER



Not a kit, but a very small ready made self contained FM transmitter enclosed in a small black metal case. It is powered by a single small 1.5V silver oxide battery, and has an inbuilt electret microphone. SPECIFICATIONS: Tuning range: 88-108MHz, Antenna: Wire antenna-attached, Microphone: Electret condenser, Battery: One 1.5V silver oxide LR44/G13, Battery life: 60 hours, Weight: 15g, Dimensions: 1.3" X 0.9" X 0.4". Some would call this a miniature "BUG" and sell it for much more than our price:

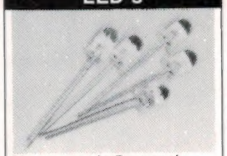
$32

LIGHT MOTION DETECTORS

Small PC.B. Assembly based on a ULN2232 IC. This device has a built in light detector, filters, timer, narrow angle lens, and even a siren driver circuit that can drive an external speaker. Will detect humans crossing a narrow corridor at distances up to 3 metres. Much higher ranges are possible if the detector is illuminated by a remote visible or IR light source. Can be used at very low light levels, and even in total darkness: With IR LED. Full information provided. The IC only, is worth $16! OUR PRICE FOR THE ASSEMBLY IS:

$7 ea. or 5 for $30

HIGH INTENSITY LED's



Narrow angle 5mm red LED's in a clear housing. Have a luminous power output of 550-1000mCD @ 20mA: That's about 1000 times brighter than normal red LED's. **SPECIAL UNBELIEVABLE INTRODUCTORY PRICE:**

60c ea. or 10 for $5

ATTENTION ALL MOTOROLA MICRO-PROCESSOR PROGRAMMERS

We have advanced information about two new STATE OF THE ART microprocessors to be released by Motorola: 68C705K1 and 68HC705J1. The chips are fully functional micros containing EPROM/OTPROM and RAM. Some of the features of these new LOW COST chips include:

- **16 pin DIL for the 68HC705K1 chip**
- **20 pin DIL for the 68HC705J1 chip**
- **10 fully programmable bi-directional I/O lines**
- **EPROM and RAM on chip**
- **Fully static operation with over 4MHz operating speed.**

These two chips should become very popular. We have put together a SPECIAL PACKAGE that includes a number of components that enable "playing" with the abovementioned new chips, and also some of the older chips.

IN THIS PACKAGE YOU WILL GET:

- **One very large (330 X 220mm) PCB for the Computer/Trainer published in EA Sept. 93, one 16X2 LCD character display to suit, and one adaptor PCB to suit the 68HC705C8.**
- **One small adaptor PCB that mates the programmer in EA Mar. 93 to the "J" chip, plus circuit.**
- **One stand alone programmer PCB for programming the "K" chip plus the circuit and a special transformer to suit.**

THE TOTAL COST OF THE ABOVE PACKAGE IS ON SPECIAL AT A RIDICULOUS PRICE OF:

$99

Note that the four PCB's supplied are all silk screened and solder masked, and have plated through holes. Their value alone would be in excess of $200!! A demonstration disc for the COMPUTER/TRAINER is available for $10. No additional software is currently available. Previous purchasers of the COMPUTER/TRAINER PCB can get a special credit towards the purchase of the rest of the above package.

OATLEY ELECTRONICS

PO Box 89, Oatley, NSW 2223

Telephone: (02) 579 4985 Fax: (02) 570 7910

MAJOR CARDS ACCEPTED WITH PHONE AND FAX ORDERS

P & P ANYWHERE IN AUSTRALIA

FOR MOST MIXED ORDERS: $2.50-$10

ICOM

Count on us!

Icom's impressive range of receivers lets you listen to more frequencies, across the band and around the world.

Starting with one of the smallest receivers ever produced, the IC-R1 covers 100kHz - 1300MHz (2 ~ 905MHz guaranteed), with AM, FM and Wide FM modes, Dual Frequency Selection and 100 memories.

The IC-R72 receives 30kHz - 30MHz (100 kHZ ~ 30 MHz guaranteed) in SSB, AM and CW modes and comes with numerous impressive features, including Icom's DDS System to improve Carrier to Noise Ratio characteristics and optional FM mode.

IC-R9000

With an Icom receiver, the world is as wide as your band

The mobile IC-R100 is packed with powerful features, and covers the 100kHz - 1800 MHz (500 kHz ~ 1800 MHz guaranteed) range in AM, FM, wide FM modes with multi-function scanning and 100 memories with 20 scan edge channels.

While the IC-R7100 covers from 25 ~ 2000 MHz in SSB, AM, FM, wide FM modes, optional TV and FM stereo adaptor, with 900 memory channels, sophisticated timer functions and multiple scan functions.

The top of the range IC-R9000 expands your listening horizons, covering 100 kHz ~ 1999.8 MHz in all modes and featuring Icom's unique CRT display, intelligent scan functions and an amazing 1000 memory channels, in a unit that delivers superb high frequency stability, even in the GHz range.

So tune in to the ones that professional listeners use, from the wide range of Icom wide band receivers.

IC-R1

IC-R7100

IC-R100

IC-R72

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P. O. Box 1162 Windsor Victoria 3181
Telephone (03) 529 7582 A.C.N. 006 092 575

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L.L. BROWN ADVERTISING 3907

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